SCIENTIFIC AMERICAN

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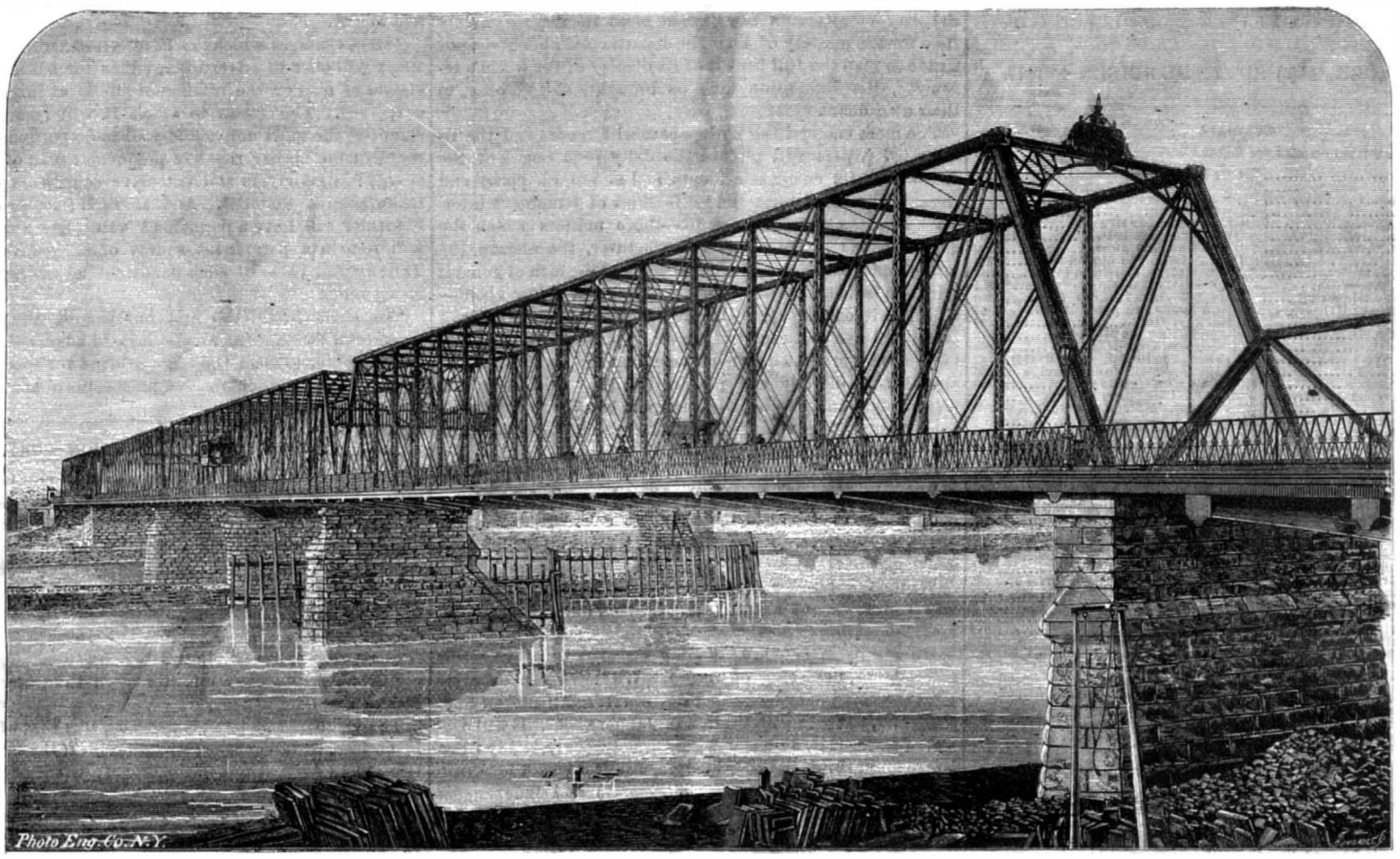
THE HUDSON RIVER BRIDGE AT TROY, N. Y.

We herewith give an illustration of the bridge which crosses the Hudson and connects Troy with West Troy. It was designed by Mr. Alfred P. Boller, and is the largest highway bridge ever built in this land of great bridges, excepting the truly magnificent Girard avenue bridge, by Clarke, Reeves, & Co., at Philadelphia. The bridge consists of (measurements from center of piers): 2 spans, 244 feet, 488 feet; 1 span, 226 feet; 1 pivot draw, 258; 1 span, 85; 1 span, 65; total, 1,122: not including the masonry approaches at either end, bringing the grade up to 34 feet above ordinary water mark. All the masonry was designed and its execution superintended by the engineer, Colonel G. Haward Ellers, and is thoroughly first-class rock-faced ashlar work The piers are all founded on a grillage supported on piles cut off at the river bottom, about 10 feet below ordinary stages of water.

The flooring of the superstructure is 37 feet wide, of which 24 feet is taken up by the double roadway. The trusses are placed 25 feet 9 inches between centers, and are so designed as to have all constructive details of wrought iron. All parts are accessible for painting and inspection, and have machine joints and pin connections, thus embodying the best features of the riveted and pin connection systems.

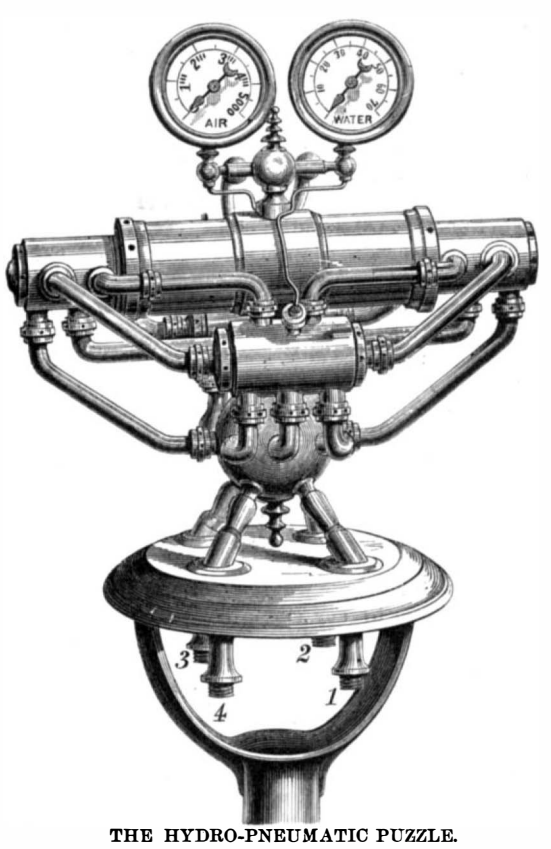
The draw span is proportioned on the theory of a continuous girder supported at center when closed, modified by the always existing open draw strains. The pivot on which the draw swings is a Parry anti-friction pivot, made by Sellers and Co., Philadelphia. All the weight is carried to the center by means of a system of horizontal radial struts and diagonal ties, pulling against a double web wrought iron drum 3 feet deep. Although weighing some 250 tuns, one man on a still day can handle this draw of 258 feet in length with perfect ease. The ends are supported by means of folding wedges, operated by line shafting of gas pipe, each way from center of bridge. The rolling load for which the whole structure has been proportioned is 2,500 lbs. per lineal foot.



BRIDGE OVER THE HUDSON AT TROY, N. Y.

The Tradesmen's Industrial Institute.---Keely Out-Keelied.

The first exposition of the Tradesmen's Industrial Institute of Pittsburgh, Pa., from October 7 to November 6, was a pronounced success, and will doubtless be regularly held hereafter. The display of industrial works and specimens was very fine. The brass work and steam and mechanical instruments of Bailey, Farrell & Co., were especially excellent; and there was one exhibit by this firm which, says the Pittsburgh *Evening Chronicle*, is "the greatest mechanical curiosity we have ever examined, inasmuch as we are utterly unable to conceive, much less comprehend, the means employed to produce the extraordinary results attained in a brief space of time. This is dubbed the Hydro-Pneumatic Puzzle, and was originally designed for the Centennial, where it will excite a degree of attention such as is seldom accorded to mechanical contrivances. This puzzle is constructed wholly of brass, is composed of a small cylinder, supported by and connected with a series of tubes, scarcely more than an inch in diameter, placed at regular intervals, similar in curvature, and all describing and reproducing Hogarth's line of beauty in outline. The cylinder is sixteen inches long, the apparatus is fifteen inches high, and about twelve in width. Apparently it weighs seventy pounds, perhaps less. A water gage and an air gage are attached. When the pressure derived from the city reservoir is employed (about 45 lbs. to the inch) the vapor or air gage, in a very few minutes succeeding, indicates rapidly 500, 1,000, and finally 5,000 lbs. to the square inch! Now, the conundrum we submit to the mechanic is: How is the result brought about? There is absolutely no movement in the pneumatic puzzle perceptible to human eye. The mystery is concealed in the cylinder and tubes. It would be as easy to run the pressure up to 10,000. We observed this water or vapor devil a moment, and were inclined to call for Keely, when it occurred to us that it out-Keelied Keely.



THE HYDRO-PNEUMATIC PUZZLE.

"Next to this really remarkable mechanical device, we think the specimen of Knowles' pump near by is the most attractive article. What with the silver plating, the perfect fitting, and the thoroughness and degree of finish displayed, it is the most noteworthy piece of complete mechanism in the exposition."

Since the above was put in type, the manufacturers above mentioned have sent us a photograph of the curious "puzzle," which we have engraved.

In their letter to us, Messrs. Bailey, Farrell & Co. say: "The machine carries a 'cold vapor' gage marked up to 5,000 lbs., and a gage to register the water pressure applied and marked up to 70 lbs. The pipe, 1, is the inlet for water pressure from the city main; 4 is the water outlet or waste; 2 is the inlet for air; 3 is the outlet for air or 'cold vapor,' if you see fit to call it that. Having the Keely motor contrivance fresh in our minds, we prefer to make no statement in regard to the machine whatever, and we put it on exhibition as the 'What Is It?' or 'The Hydro-Pneumatic Puzzle.' Let those who can make it out. It was made for and will be exhibited at the Centennial. When we make public the workings of the machine we will write you. It is on public exhibition, not running for 60 seconds, but right along. We prefer not to solve our own puzzle."

We are sorry that our Pittsburgh friends should, like the Keely people, decline to explain how the trick is done. But perhaps the mind's eye of some of our ingenious readers, with the data given, can penetrate the brass cylinders, ascertain the interior construction, sketch, and send it to the SCIENTIFIC AMERICAN.

J. P. N. says: "I would state that the experience in New York State, with a class of water wheels which carry an immense load upon the stepping, indicates that the dyewood fustic is incomparably the best wood for bearings."

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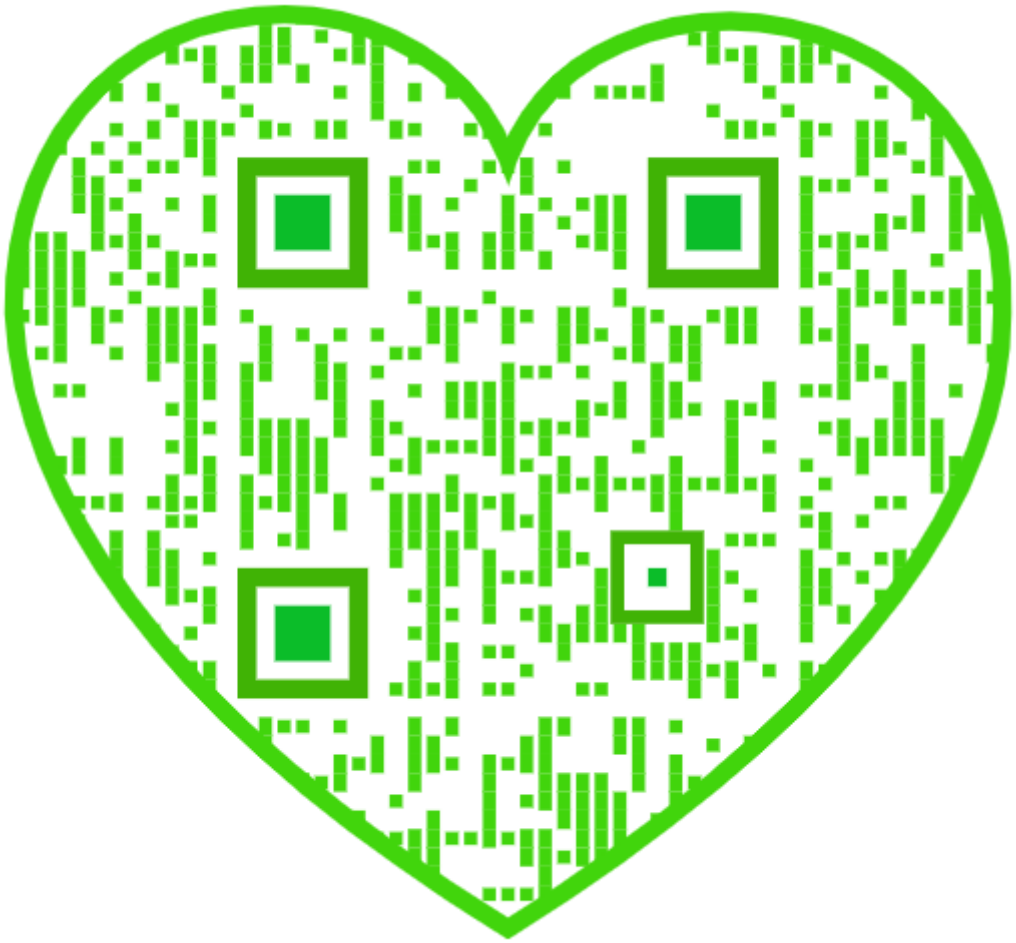

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VOLUME XXXIII., No. 23. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, DECEMBER 4, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

Alloy balance*..... 361
Answers to correspondents..... 363
Astronomical notes 360
Awl handles*..... 361
Awnings*..... 361
Axe tester*..... 361
Axle gages, etc.*..... 361
Baggage checks*..... 361
Barometrograph, the*..... 361
Belting abroad, American. 354
Belting *vs.* frictionalgearing..... 357
Belts, rubber, slip of (11)..... 363
Blind hinge, improved*..... 355
Boilers not in use (7)..... 363
Brass for boxes (12)..... 363
Brass wire for rivets..... 358
Bridge at Troy, N. Y.*..... 351
Burglar alarm*..... 355
Business and personal..... 363
Carbonic acid from roots*..... 355
Castings and patterns (6)... 363
Cement for emery and cast iron (9) 363
Cow tail holder*..... 355
Culinary apparatus, new*. 358
Disease, the money equivalent of. 353
Electricity from the clothes (2)... 363
Electric light and heat*.... 356
Elephants, a plea for the wild..... 357
Engine, oil, the Brayton..... 355
Engraving tools, hardening (7).... 363
Exposition, the International..... 352
Fires, extinguishing by steam..... 358
Floors, polishing (14).... 363
Garbage, use for New York..... 355
Gear cutting, index for (10)..... 363
Gold jewelry, coloring (4)..... 363
Governor, improved*..... 354
Gun barrels, twisted (15)..... 363
Health Association, the Public.... 353
Horse disease, the..... 353
Hydropneumatic puzzle, the*..... 351
Inventions, miscellaneous*..... 361
Ironclad vessels*..... 359
Irresolution. 360
Keely, another rival for..... 358
Keely out-Keelied*... 351
Krupp and his guns..... 360
Light, improved dioptric*..... 355
Locomotive, starting a (5)..... 363
Locomotives working gradients*. 354
Magnets, iron for, etc. (16)..... 363
New books and publications..... 362
Norway, from..... 358
Oils, testing the fatty..... 360
Oilstones, truing..... 360
Paint for hard-finished walls (14).. 363
Patents, American and foreign.... 362
Patents, official list of..... 363
Pattern core boxes (17) 363
Patterns for scroll saw work..... 353
Poison stories, curious..... 353
Pulley block, improved*..... 354
Recipes, useful.... 357
Rhinoceros, skinning a..... 356
Sadiron, improved*.. 358
Seeds, the germination of..... 358
Sewing machine monopolists, the 358
Sounding apparatus, new*..... 357
Steam, cutting off and throttling (3) 363
Steel ships in England..... 357
Swedenborg as a chemist*..... 354
Taps, heads of..... 358
Taps, thread-cutting by..... 358
Teetotallers, argument for... 352
Telegraphs, wire for (18)..... 363
Ventilating by machinery 353
Volcanic action, source of..... 353
Water gas delusion, the..... 352
Water wheel bearings..... 351
Woodwork, the protection of..... 357

PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. Three numbers (including the present) and the year will be ended. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the continuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper.

To save our friends all the trouble possible, we also inclose an envelope with our address printed thereon, so that all the subscriber and getter-up of a club has to do, is to place his name or list of subscribers in the envelope, with the postal order, draft, or money, put a 3 cent stamp on the former, and drop it into his post office.

The terms of subscription remain as heretofore—$3.20 per annum, postage prepaid by us, for single subscribers, with discount for a number. See terms for clubs in special prospectus. All news dealers throughout the country will, as usual, receive subscriptions and have our publications on sale.

THE GREAT INTERNATIONAL EXPOSITION.

The coming Centennial Anniversary of our existence as a nation, celebrated as it will be by the grandest display hitherto seen of the world's natural and industrial products, will have something more than a political interest and significance.

The century just closing has been a century unique and unrivaled for its contributions to the mental and material advancement of humanity: a century in which the Sciences, pure and applied, have passed from the stage of weakness, uncertainty, and general neglect to the very forefront of human progress, creating in their passage an entirely new type of civilization and adding more to human power and comfort than all the agencies that had previously been brought to bear on them. As never before, man is master of Nature's materials and forces, and mainly through the achievements of the past hundred years.

What the coming century has in store for us, what advances man is destined to make in knowledge and power, it is impossible to forecast; it is nevertheless easy to see that what has been done and gained is little more than the prelude to the more magnificent achievements the future will have to record. It is therefore a peculiarly appropriate time, as we celebrate the first centennial year of our history, to review not merely what we have accomplished during our years of national infancy, but to compare our present standing in material wealth and progress with that of the other leading countries of the world.

To those who can spend the summer at Philadelphia—and nothing less will suffice to enable one to master the wealth of instructive matter to be gathered in the extensive halls of the Exhibition—the opportunity there afforded to become directly familiar with the present state of the world's industrial advancement will be incomparably superior to anything ever offered before on this continent, or likely soon to be presented elsewhere. But of the hundreds of thousands who will throng the Exhibition Buildings, not many will be able to spend more than a few days at most in them—scarcely time for the mastery of a single department. For the multitude to reap the full benefit of its display of the world's resources, the Exhibition must be brought, so to speak, to their own doors.

The more enterprising newspapers will report and the illustrated papers will picture the daily occurrences of the Exhibition, its current incidents and gossip, its pomp and show, its hourly doings, and its features of temporary interest. But its substantial results—those matters which the engineer, the inventor, the manufacturer, the artizan, the man of practical science, the merchant, and the man of general scientific taste and culture will care most to know about—will lie without the sphere of the popular press. Yet it will be to the large and rapidly increasing portions of the reading public represented by such men that the Exhibition will appeal most directly and powerfully; they will have the largest stake in its collections, and will be able to derive the most immediate advantage from the varied instruction the Exhibition is intended to furnish.

It is the purpose of the publishers of the SCIENTIFIC AMERICAN to provide for the Centennial wants of this large and intelligent class, and to do for the substantial features of the Exhibition what the popular press will do for the incidental and trivial.

While the regular edition of the SCIENTIFIC AMERICAN will convey to our readers, every week, an extensive and most interesting general view of the Exposition, our ordinary space will be inadequate for a large remainder of scientific information, deserving of record. We have concluded to meet the emergency by issuing a SCIENTIFIC AMERICAN SUPPLEMENT, to begin with the first of January next. It will consist of sixteen large quarto pages, issued weekly, richly illustrated and printed in the best style, uniform with the SCIENTIFIC AMERICAN, but in effect a separate and independent publication. The terms of single subscriptions to the SCIENTIFIC AMERICAN SUPPLEMENT will be $5.00 a year by mail. The two papers, the SCIENTIFIC AMERICAN and the SUPPLEMENT, will be furnished together for $7.00 a year, postage paid by us.

It must not be inferred from this announcement that the SCIENTIFIC AMERICAN SUPPLEMENT will infringe in any respect upon the field now occupied by the SCIENTIFIC AMERICAN. It will be strictly what its name implies, presenting, so to speak, the overflow of valuable matter which heretofore we have been unable to utilize for lack of space. We shall endeavor not merely to hold the SCIENTIFIC AMERICAN up to the standard of excellence it has achieved thus far, but to improve upon the past; and we may properly observe in this connection that the arrangements entered into for increasing the value of our paper for the coming year are fuller and more liberal than ever before.

Primarily the SCIENTIFIC AMERICAN SUPPLEMENT is designed to illustrate and describe the many interesting subjects and objects presented in the various departments of the Exhibition with great fullness and detail, with such an abundance of engravings and working drawings as will place the natural and industrial riches of the Exhibition clearly and vividly before its readers: not, however, as a dry catalogue of the best things the genius of man has accomplished, but with a liveliness of description that will interest more than those directly and specially connected with industrial affairs.

In addition to the special matter pertaining to the International Exposition, the publication will embrace a very wide range of contents covering the most recent and valuable papers by eminent writers, in all parts of the world, in all the principal departments of scientific investigation and useful knowledge. There will thus be, what has never been attempted hitherto by any single publication, a weekly review, full and comprehensive, of the world's best thought and action.

While it will address the great body of intelligent readers interested in the scientific and industrial progress of the world, the SCIENTIFIC AMERICAN SUPPLEMENT will be specially valuable.

TO MANUFACTURERS, as it will not only describe and illustrate in detail the best machines introduced into each and every branch of mechanical production, but, in the department of Technology, will furnish early information of all new and useful inventions and discoveries relating to the chemical and mechanic arts.

TO METAL WORKERS, as the department of chemistry and metallurgy will embrace accounts of all the chief chemical discoveries and improvements in the process of working the various metals, with engravings of new apparatus, descriptions of new alloys, and much other related information.

TO ENGINEERS, since it will furnish the latest and best papers upon steam engineering, railway engineering, mining and civil engineering, millwork, textile industry, etc., with engravings and working drawings, besides full accounts of the latest improvements in telegraphy and telegraph engineering, in electric batteries and engines, and all new and useful applications of electricity in the Arts.

TO ARCHITECTS, as it will furnish examples of the best new structures, with details and drawings of plans, elevations, etc, with a large amount of information relating to the production and improvement of builder's materials, and collateral matters.

TO STUDENTS and SPECIALISTS, inasmuch as, while it will furnish the latest intelligence of inventions, discoveries, and improvements in each department of scientific thought and enterprise, it will aim not only to keep the specialist promptly advised of all that is best worth knowing in his particular department, but will furnish from week to week such a general review of human progress as to enable him to keep the run of the Sciences with the least outlay of time and money.

The advantages which the SCIENTIFIC AMERICAN SUPPLEMENT will offer to advertisers, either for addressing special classes of men or the intelligent public at large, cannot be surpassed. The classes to which it will be addressed will comprise the most active and well-to-do portion of the community: the higher ranks of producers: men of genius and energy: large buyers and extensive consumers of raw and manufactured material. And as each number of the SUPPLEMENT will have a permanent value, its announcements will remain a permanent source of suggestive reminders. The superior value of such persistent advertisements needs no arguments.

We shall issue the first number of the SCIENTIFIC AMERICAN SUPPLEMENT some days in advance of its actual date, in order to meet the large demand for specimen copies. For additional particulars, see prospectus in another column.

THE WATER GAS DELUSION AGAIN.

This old device has been revived, and is now on exhibition in Brooklyn and a few other places. It consists simply of an inverted bell jar plunged in a vessel containing diluted sulphuric acid and zinc. The water is decomposed into its constituents, oxygen and hydrogen. Free hydrogen gas escapes, while the oxygen of the water combines with the zinc to form oxide of zinc, which, in its turn, combines with the sulphuric acid to form a soluble salt. The operation, therefore, results in liberating hydrogen from water, and changing the zinc and free sulphuric acid in the water into a solution of sulphate of zinc.

The value of this process depends, like that of most other inventions, on the expense attending it. If the cost of production is less than that of common gas, or equal to it, or even slightly above it, the water gas may compete with the coal gas, as the convenience of being independent of the gas works is worth something. But if the cost is more than $27 per thousand cubic feet, while common gas costs $3, less than one ninth, it is evident that water gas can never hope to meet with popular favor. The calculation of expense is simple enough to any one acquainted with the fundamental principles of chemistry The chemical equivalent of zinc is 64, that of water 18, and of the constituents of water, oxygen and hydrogen, 16 and 2, respectively. Therefore if we wish to decompose water, by means of zinc, into its constituent elements, it takes 64 lbs. of zinc to decompose 18 lbs of water, by combining with its 16 lbs. of oxygen and liberating its 2 lbs. of hydrogen. Therefore for every 2 lbs. of hydrogen liberated, we must consume 64 lbs. of zinc, which will be changed into 80 lbs. of oxide of zinc. But the process cannot go on without an acid to dissolve the oxide of zinc; and for this purpose the cheapest and best is sulphuric acid, of which the atomic weight is 80; therefore 80 lbs. of acid will be required, to combine with 80 lbs. of zinc, and the result will be a solution of 160 lbs. of sulphate of zinc. Let us now estimate the expense of producing these 2 lbs. of hydrogen gas. The 64 lbs. of zinc will cost, at 9 cents per lb., $5.76; 80 lbs. of absolute sulphuric acid is required, and about 150 lbs. of the hydrated commercial acid will be needed at 2½ cents per lb., costing $3 75. Total, $9.51. For this amount we have 2 lbs. of hydrogen gas; and in order to calculate its value in cubic feet, we consider that one cubic foot of water weighs 64 lbs., that air is 750 times lighter than water, and hydrogen 15 times lighter than air, or $15 \times 750 = 11{,}250$ times lighter than water. Therefore 11,250 cubic feet of hydrogen will weigh 64 lbs.; and dividing both these numbers by 32, we find that 350 cubic feet of hydrogen will weigh 2 lbs.; and as 2 lbs. cost $9.51, that sum is the price of 350 cubic feet of hydrogen, while, according to this, 1,000 feet of hydrogen will cost $27.17.

But this is not all. The hydrogen burns with a pale, almost invisible flame, and must be passed through a carbonizer, consisting of a vessel containing turpentine, gasolin, benzole, or some other volatile hydrocarbon, in order to make it luminous. But we will assume that the cost of this is covered by the value of the sulphate of zinc solution, which might be sold to a chemist, for evaporation and crystallization into dry sulphate of zinc. It is, however, almost worthless, as the large amount of the salt put into the market by the telegraph offices makes the product of little account.

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CURIOUS POISON STORIES.

A story is going round the daily press, to the effect that a man once spit into a rattlesnake's mouth, and the snake died; he did the same thing to an adder, and it died also. Another adder would not open its month, so he spit on a stick, rubbed the spittle on the adder's nose, and it died. A non-poisonous black snake was treated in the same way, but it did not die; and the conclusion is drawn that human saliva is as poisonous for poisonous snakes as the poison of snakes is for man.

In order to realize the improbability of this story, we will state that the poison of snakes is not their saliva, but a special fluid secreted in a bag situated near the root of the poisonous fang, which is provided with a channel to conduct the poison from the bag to near the point, so that it may be injected into the wound.

Many poisons, dangerous if given by injection, are harmless in the stomach, where, by the digestive powers of the gastric and other juices, they are decomposed and made harmless. So the vaccine virus, which by inoculation produces the well known ulcer, is perfectly harmless when swallowed; and several other organic poisons, especially of the septic kind, of animal origin, are only dangerous when entering the system by a wound, and may with impunity be taken into the mouth and stomach. An excoriation or scratch on the lips or tongue, by which they may enter the circulation, is dangerous, as has been proved by many examples. Hence the danger of wounds during dissection by medical students, by which the decomposed animal matter of the subject enters the circulation, and kills the poor victim rapidly; while students with an unimpaired skin on their hands may dissect any subject with impunity. A case is on record of a young lady who kissed the dead body of her father. She had a little excoriation on her lip, which was touched by the moisture on the lips of the corpse; it soon inflamed with all the characteristics of a virulent dissection wound, and in a few days she was a corpse also. The poison had entered into the circulation of her blood.

Experiments in this line are of course highly objectionable; but as far as experience has shown, most poisons of this kind may with impunity be taken in the stomach. If the saliva of man or animals has any dangerous qualities, it is mostly only manifest when entering the circulation of the bitten individual, and especially when the saliva has been changed in its nature by the excitement of passions, such as great fear, anger, etc. Hence arises the often malignant appearance of bites by infuriated men or animals; while the introduction of such saliva into the stomach would undoubtedly, in most cases, not be attended with serious consequences. This shows the absurdity of the idea that the normal human saliva should be a poison in the mouth of any animal, whether possessing poison bags connected with its teeth or not.

The story reminds us of one which went round the papers some years ago, about a man who was bitten by a rattlesnake through his boot. Long after his death, every one who tried on that boot died of the consequence of a scratch in the foot, produced by a serpent's tooth projecting inside the boot; and the cause of the mischief was only discovered when many persons had been killed. The inventor of this story did not know that the rattlesnake poison is only active when freshly injected from the poison bag.

THE SOURCE OF VOLCANIC ACTION.

Volcanoes have long been considered as having their origin in the liquid interior of the globe. This view is still held by some of our best physicists and geologists, though others hold widely different views. While some believe that the internal heat is the cause of volcanoes, others hold that both heat and volcanic phenomena are due to the motion resulting from lateral pressure transformed into a sufficient degree of heat to produce volcanic action, and the question is receiving no little discussion in scientific circles at the present time. The distribution of volcanoes is confined very largely to the boundaries of continents bordering on oceans or seas, or on islands within these bodies of water. This fact leads to the conclusion that water has something to do with volcanic action. And it has been explained by supposing that, as the subsidence of the oceanic regions necessitates the elevation of the continental regions, the shore lines are subjected to a great strain from being the fulcrum point of leverage. This strain results in fracture which admits the water to the heated parts below, and this, by its sudden expansion, forces up the melted material to the surface. The unequal straining, of the submerged crust in subsidence, would cause fracture which, by admitting water, would account for oceanic volcanoes. Continental volcanoes may be due to the pressure of shrinkage which forces the molten matter through mountain fractures, because they are the places of least resistance.

Whether volcanoes originate in a molten nucleus or stratum beneath the crust, which would naturally be homogeneous throughout, or from isolated molten material like subterranean lakes or reservoirs, is largely demonstrated by a consideration of the material brought to the surface by volcanic energy. If this is uniform in its chemical properties. it would argue a common source; or a variety of sources, if the ejected matter varied in its composition. It is found, by inspecting the material thrown out from different craters or fissures, that it differs widely in composition; and even that the lavas of the same volcano vary at different periods. Phillips, and later Durocher, accounted for this diversity of composition on the supposition that the interior fluid mass separated into different strata, according to the density of its components, and that sometimes matter from one of these was ejected, sometimes from another, and again from a mixture of two or more at once. It may also be explained by supposing that each eruption was the result of local chemical action which melted the rock, and, by thus increasing the pressure, forced it to the surface. Hunt and others explain it on the probable supposition that the originally cooled crust is anhydrous, while the sedimentary deposits are all impregnated with water. When the internal heat invades the position of these, the presence of water would greatly facilitate fusion; and the injected matter would vary in composition according to the composition of the stratified deposit which was subjected to the degree of heat requisite for fusion. This Hunt, Babbage, and others consider a "ready explanation of all the phenomena of volcanoes and igneous rocks."

On the other hand, Robert Mallet concludes "that the crushing of the earth's solid crust affords a supply of energy sufficient to account for terrestrial volcanicity," and has calculated that the crushing of 7,200 cubic miles of rock would cause heat enough to make all the volcanic mountains of the globe. These views have been vigorously opposed by Professor Hilgard, of the Michigan University, and Rev. O. Fisher, of England. They claim that Mallet's experiments of crushing 1½ inch cubes of rock, and producing a heat of 217° Fah., are not sufficient to prove that the crushing of solid rock could produce fusion. Hilgard claims that the friction of the crushed and powdered particles would be necessary in addition, and implies that the resistance of the rock would be "materially diminished by the downward increase of hypogeal temperature." Mr. Fisher claims that, if crushing rock will produce fusion, the cubes Mallet crushed in the air should have been fused. He also objects that a horizontal prism of rock, ten miles long and one in sectional area, if crushed, would have the heat uniformly distributed, and nowhere sufficient to cause fusion; and asks, if it fuses in certain parts, what determines the localization?

Mallet meets these objections by saying, first, that the pressure on rock 10 or 20 miles below the surface would be 2·14 or 4·28 times greater than at the surface. This would necessitate greater "work" to crush it, and hence cause greater heat. This, added to the 1,000° or 2,000° of heat 10 or 20 miles deep, would be sufficient, in his estimation, to fuse rock. In his experiments, he subjected the stone cubes to pressure on only two opposite sides, leaving the other four sides free; and if the six sides had all been pressed simultaneously, it would have required much greater force and produced much more heat. Again, in his experiments, the crushing force was so slow, comparatively, that much of the heat was carried off by the steel plates during the process. But in the earth's crust the pressure is on all sides, and the force acts so suddenly that there is little or no time for diffusion of the heat produced. As to the localization, he says, that if the rock be homogeneous, the greatest force of pressure would be excited at the surface which is in contact with some fixed rock, and here the melting would commence. He instances, in proof of this, rocks in the foundations of buildings and masonry, when subjected to too great pressure, which have thus been crushed or "spalled" off, and always at or near the joints. If not homogeneous, the crushing would commence at the weakest place; and in either case the crushing must be localized either at the end or ends of the prism, or at the place of weakness where it first yields. Again the temperature of each succeeding foot of rocks will be raised by the heat imparted from each preceding foot of rock that is crushed. Now since the pressure is 4·28 times greater twenty miles down than at the surface, this multiplied by 217° gives 928° of crushing temperature for the first foot, and the following feet would increase correspondingly in temperature.

Mallet illustrates his points by noting the fact that the resistance of air before a moving meteorite is sufficient to make the latter red and even white hot; and the greatest heat occurs in immediate contact with the moving body, where the air is subjected to the greatest pressure. Also in cutting a cast steel file in two by the rapid rotation of a soft sheet iron disk in contact with it, the greatest heat is developed at the working point, and here the file is softened and cut in two by means of the heat remaining in it, while the air carries off the heat from the disk in its revolutions. Cutting of railroad bars by a similar process is another illustration in point. The exaltation of temperature by the work of modifying the form of a body is also clearly seen on rapidly hammering tough iron, when after a minute or two it becomes red hot, then in a second or two it reaches nearly white heat. Mallet takes into the account the additional heat caused by friction of the crushed particles, as suggested by Professor Hilgard, but says he knows of no experiments that prove its amount, and that it cannot be determined in any other way. The other objections which Professor Hilgard raises, namely, that the increase of heat from the surface toward the center would soften the rocks more and more as their distance from the surface increased, and consequently cause the production of less heat from their displacement by lateral pressure and crushing force, is doubtless a very weighty and important one; but Mallet seems not to have given it an adequate answer.

Professor J D. Dana, probably the best geologist on this continent, does not accept the conclusions of Mallet, but holds that "igneous eruptions must for the most part have come from great fire seas, and had their origin in the earth's original liquidity." To substantiate this view, he instances the great dolerytic ejections of the triassico-jurassic era, which extended from Nova Scotia to South Carolina—a distance of 1,000 miles, and the far greater trachytic eruptions of later eras over the Pacific slope of North America. The matter thrown out from each of these very broad areas, being the same in character throughout, points unmistakeably to the conclusion that in each case it must have come from one great fire sea or the molten interior of the earth. At the time this matter was ejected, it must have come from a common source; but the connection of all its parts may not be retained till the present time, but may have become cut off by subsequent cooling.

THE MEETING OF THE PUBLIC HEALTH ASSOCIATION

A meeting of the American Public Health Association was recently held in Baltimore, Md. Several interesting papers were read. The abstracts below given are selected from the most interesting of the papers read.

VENTILATING BY MACHINERY.

Mr. Carl Pfeiffer said, in substance, that, through the difference of from 30° to 40° between outer and inner air, a sufficient ventilation in an apartment may be obtained in winter, but not in spring, summer, or fall. In these seasons it will be necessary to resort to mechanical means, which the best authorities consider generally to be nearer perfect than any other ventilating system. Mr. Pfeiffer thought that owners of tenement houses should be forced to supply proper ventilating machinery which should be located out of the reach of the tenants.

A NEW ARGUMENT FOR TEETOTALLERS.

Dr. Hitchcock suggests a new raid on the liquor dealers, for causes which will add a novel argument to those already urged by total abstinence advocates. The vital statistics of the United States, he says, show a mortality of from 7 to 16 per cent traceable to the use of alcoholic drinks. In New York, $56 a year for each inhabitant is spent for such beverages, by which life is shortened 28 per cent. Each State should ascertain, by a commission, how much loss it suffers from the traffic in liquor, and should assess that loss on the dealers equitably according to their sales.

THE FINANCIAL EQUIVALENT OF DISEASE.

A remarkable paper on this subject was read by Dr. Benjamin Lee. The object was to determine the loss sustained by the city of Philadelphia in dollars and cents through the epidemic which occurred there in the winter of 1871-2. Dr. Lee calculates the loss by diminution of travel and traffic on the railways, and loss to hotels, to merchants, and to business generally. He also computes the loss due to sickness and diminished production and by death. He sums up his calculations as follows: Expenses incurred in care of sick, $203,879; loss by sickness (time), $1,072,065; loss by disability (time and expenses), $10,000,000; loss by death (based on estimate of value of a life to society), $5,013,000; burial expenses, $74,420; total, $16,363,364. As the epidemic was due to neglect of sanitary precautions and might have been prevented by judicious sanitary legislation, the above represents in cash the money equivalent of the disease, which was wholly lost to the community.

A NEW USE OF NEW YORK GARBAGE.

Mr. Jackson S. Schultz suggested a new use of the garbage of New York. His plan was to buy one or more of the islands in Long Island Sound, erect sheds, and colonize 60,000 hogs, which should be fed with the garbage by the paupers and criminals of the city, under the control of officials wholly independent of political supervision or influence.

THE HORSE DISEASE.

The *anthrax epizoötic* was the subject of a valuable paper by Mr. Law of Cornell University.

The most universally acknowledged causes of the malady in animals are: Plethora, or a state of the blood highly charged with organic elements; an impervious soil or subsoil: a very rich surface soil; inundations; a period of heat and dryness calculated to foster the decomposition of organic matters to a great depth in the ground, and great contrast between the day and night temperatures; and in one case all coincided to produce one of the most malignant types of the disease. It may be added that, while this affection is communicable to all animals by inoculation, it can scarcely be said to spread in any other way, and is therefore to be looked upon as essentially an enzoötic disease. We must go to such places as the inundated margins and deltas of large rivers, dried-up lakes and marshes, or the rich and pestilential Russian steppes, to find any approximation to the disastrous outbreaks in man and beast which blacken the history of past ages.

It only remains to be noted what was done to check the disorder. One hundred of the best steers were turned on a higher pasture with a gravelly subsoil. The remainder were of necessity left in the higher of the two meadows formerly occupied, but were fenced out from the swamp and lower meadow where the clay approached to the surface. All of both herds were fed with hay and watered with a solution of carbonic acid and bichromate of potassa. The fifty sick bullocks took small doses of nitro-muriatic acid and bichromate of potassa by the mouth, and a solution of sulphate of quinia, iodide of potassium, and bisulphite of soda hypodermically, each repeated twice daily. The result was that of fifty animals seriously ill only two died, and the rest made a prompt and perfect recovery.

F. A. A. says, to amateurs wishing to mark patterns for scroll saw work: Take the bracket or other piece of work which you desire to copy, and spread over it a sheet of paper, securing it from slipping. Rub gently over it a piece of saddler's black leather, All the outlines will be marked accurately, and it takes but a minute to copy any piece. The saving in money for patterns, which cost from 10 to 20 cents in the stores, is therefore considerable, and it is often impossible to get a pattern of some particular thing which strikes your fancy."

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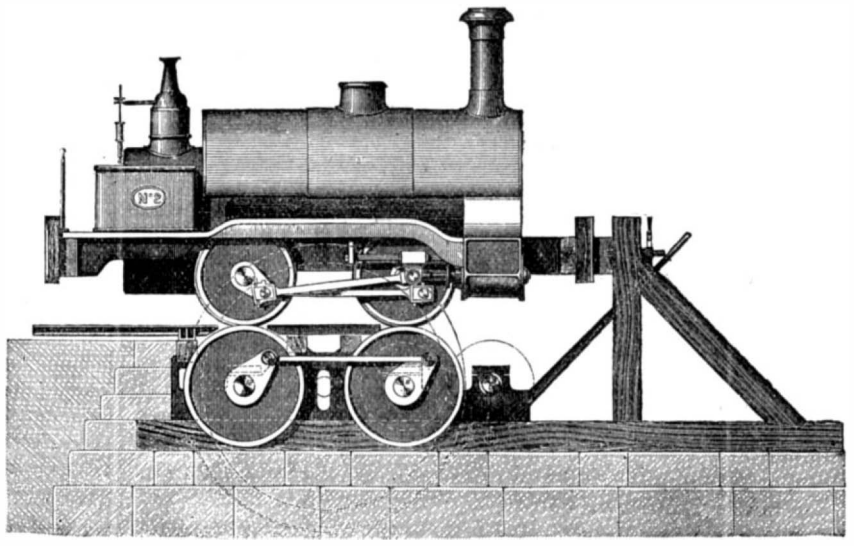
WORKING STEEP GRADIENTS BY LOCOMOTIVES.

We illustrate herewith a noyel system of working trains on steep railway gradients by locomotive engines, patented by Mr. Graham Stevenson, of Airdrie, and Mr. John Reid, of the Provanhall collieries, near Glasgow, Scotland. The apparatus has just been erected at the collieries named.

The incline selected for the first application of this system leads downwards from the main rails of the Caledonian Railway to two pits about three quarters of a mile distant, with an average gradient of about 1 in 13, and ranging between 1 in 11 and 1 in 15. About six years ago Mr. Stevenson's firm constructed two powerful tank locomotive engines to work this incline, the steepest, perhaps, with one exception, worked by locomotive power in the kingdom. The traffic from the pits has so increased of late as to make it impossible for the engines to overtake it, and the construction of a third engine, or some other means of assisting the two, came to be a matter for consideration. With the latter view it was proposed to erect a small stationary engine, working a wire rope; but in place of a stationary engine, the idea of stationary gearing, which might be acted on by one of the locomotive engines, occurred to the patentees, and this idea has been put into practical operation. Since that time the machinery has been inspected at work by a large number of engineers and and colliery proprietors, many of whom have expressed decidedly favorable opinions regarding it.

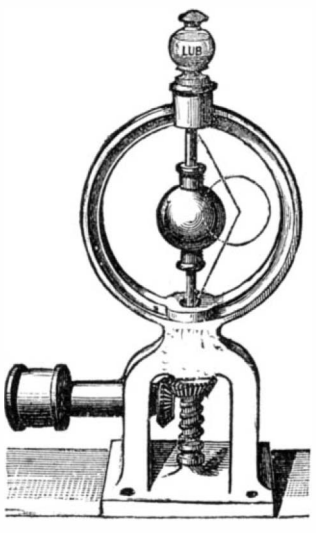


WORKING STEEP GRADIENTS BY LOCOMOTIVES.

Our engraving is a side elevation, showing a locomotive in the position for actuating the winding gearing. The winding drum and its gearing are mounted in suitable bearings on framing fixed in a stone-cased excavation below the line of rails on which the locomotive is brought to the spot. The shaft of the winding drum has fast on it a spur wheel, in gear with a pinion on an intermediate shaft, which has also fast on it a pinion in gear with a pinion on one of a pair of shafts. These shafts have wheels fixed on them, with their uppermost parts at the level of the rails, and with cranks on them connected by rods. The rails are cut away at the parts where the tops of the wheels are; and when the locomotive, having two pairs of coupled wheels, is run into position up against a buffer bar, and secured there by a screw, its four wheels rest on the four wheels below, the entire weight of the locomotive serving to impart driving power by adhesion. Then on the locomotive being made to drive its own wheels, these, acting frictionally on the wheels below, drive the winding gearing. The rails form part of a siding, while the winding drum is on the line of the incline. When the train is brought to the top, the locomotive is freed from its anchorage, runs out, and engages the trains on the level, disposing of it as desired. In lowering the empty trucks down the incline, the pinion is disengaged, and the drum controlled by the friction strap and lever. The amount of work capable of being performed with the new arrangement is four times greater than before, when the delays consequent on running the locomotives up and down the incline, shunting, coupling, sanding, etc., are taken into account, the cost of labor remaining the same, while the wear and tear of the rails and engines is very greatly diminished.

MEIN'S PATENT GOVERNOR.

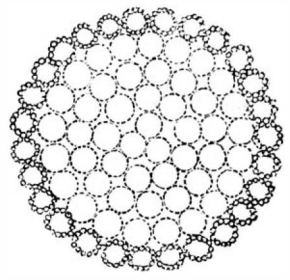
This governor depends for its action on the same principle that operates if we pass a cord through a bullet and cause the bullet to revolve in a plane; the cord being held at each end, these ends will be pulled toward each other. A heavy ball is made up of two half balls united by a horizontal central pin; each half ball is fixed to a rod; the top rod terminates in a ball carried in a socket in the top of the frame just under the lubricator; the bottom rod ends in a plain jaw, which takes hold of a rod guided in the frame, and fitted with a miter wheel sliding on a feather as shown; on this rod is a collar and spiral spring to aid gravity; the fork to the throttle lever takes into the collar at the bottom. If the ball were perfectly symmetrical when it was caused to revolve on its axis, it would not diverge in any way; but the center of gravity not coinciding with that of rotation, the ball diverges and tends to assume the position shown in the dotted lines, the halves of the split ball turning on each other



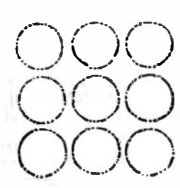
This is a very simple governor, neat in appearance, cheap, and sensitive. It has been fitted in some important mills, and is, we have reason to believe, giving much satisfaction.

Swedenborg as a Chemist.

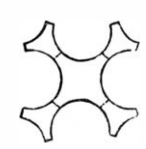
According to the views held by Swedenborg, the particle of water is built up in this way: The natural point constitutes the beginning of all things, in the same way that the geometrical point constitutes the beginning of geometry, and is thus a medium between the infinite and the finite. The natural point is described as being produced immediately from the infinite, its exact nature being scarcely conceivable; it consists, however, of pure and total motion, and analogy might lead one to compare it with a spiral force. Unfortunately for this theory, it happens that in all arguments as to the origin of matter it is precisely this medium between the infinite and the finite, this natural point, which constitutes the point in dispute. We do not see that its comparison to a spiral force gets over the difficulty. The next steps also depend entirely on the imagination. One point is held in equilibrium by another, and hence we have a species of concrete motion, or a motion which is local and gyratory, and thus distinguished from the all-prevading motion of the infinite; at least, this is the way we understand the author. This complex motion is termed an active finite, and its complexity is increased by a second process of development, whereby the first active finites are held in mutual equilibrum, and a second finite is produced, and so on up to the fifth. In Swedenborg's view the particle of water is reduced to a further development, wherein the sixth step is reached, and its character may be illustrated by the annexed diagram.



It will be seen that the particle of water is round, and that the sphericity is the natural outcome of the theory of its development. The individual particles of water are held to be arranged in the fluid quadrilateral pyramidal position, wherein each particle is separated from the other by the penetrating and dispersive power of heat, shown in the second engraving. In the deepest parts of the sea, where the solar heat does not penetrate, this perfectly fluid position of the particles cannot be maintained, and they accordingly assume a fixed quadrilateral pyramidal position, easily imagined by bringing into close contact four of the above circles, and imposing another circle on the center to cover the space intervening.



The partilces of water being thus arranged, an increase in pressure results in the breaking up of some of the aqueous particles, of which the compouent parts go to fill up the cavities and spaces of the remaining, intact, particles of water. According to Swedenberg, this disintegration or decomposition gives rise to the salts and metals, and the character of the new substances produced depends on the shape of the interstices. Thus, for instance, salt owes its acidity to the spiculæ which surround a body formed by the juxtaposition of spheres. The shape of the particle of common salt, according to this theory, consists of one cube and several triangles: to be in perfection, it ought to consist of one cubical body with eight triangles or points, as shown in the third engraving.



Variety in the characters of salts is produced by the breaking off of one or more of these points, so that the less number of spiculæ will give rise to a salt possessing less acidity, because there is a similar number of spiculæ to produce acidity. The spiculæ of these bodies are consequently the acids, and the body without any points would be without taste or acidity, and would constitute some kind of earth. When heat is applied to a salt, an acid is supposed to be produced by the volatilization of the points, while the stoma remains behind and forms the earth. The author does not explain why the points are volatile, and not the body, which we should expect to be equally so, seeing that it is supposed to have been produced contemporaneously with the points by the disintegration of like particles of water.

The different kinds of acids are held to be produced by the conjunction in various matters of one or more of the acid spiculæ, which is the simplest or first kind of acid. Niter is supposed to consist of a central volume of subtle fiery matter around which are disposed the acid particles. Swedenborg's theories of oil, sal ammoniac, and lead are developed by a like method of reasoning without facts, and with a full flow of imagination; but we think the example we have given will afford a sufficient illustration of the author's views.—*Chemist and Druggist.*

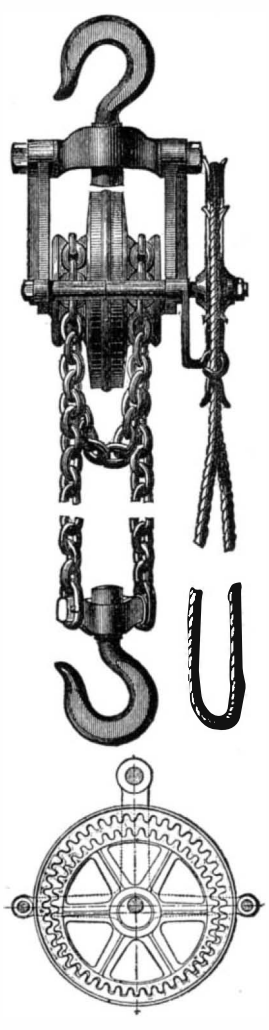
American Leather Belting Abroad.

Our English contemporaries are very unhappy over the introduction of American products into their country. Almost every trade journal that comes to us from abroad has something to say about our encroachments upon their manufacturing interests. The last *British Trade Journal* says:

"It is certain that the Americans are actively bestirring themselves at the present time, with a view to getting certain of their manufactures into the British market. Their iron and hardwares have already got a footing—and in the latter case a by no means despicable one—here; their cotton manufacturers have made the first sign of advance towards a region hitherto dominated by Manchester; and it would seem that the leather trade is now to feel the influence of American competition. It will interest Birmingham and Walsall to know that the first invoice of leather belting has recently been shipped by a New York firm, who, we are told, work up in their Brooklyn manufactory ten thousand hides per annum. The order for the shipment referred to was placed by our great gun manufacturer, Sir William Armstrong, and included two belts of unusual dimensions, one being 2 feet 8 inches wide and 94 feet long, and the other 18 inches wide and 123 feet long, and of double thickness. Leather belting is largely manufactured, as is well known in the centers of the trade, in this country, and as regards material and workmanship could scarcely be surpassed. We can only suppose, therefore, that an English firm was led to place an order for such goods in America by some advantage on the score of price. The American manufacturers deserve all credit for the enterprise and energy they are showing in their efforts to compete with British makers in their own market. What possible chance could they have of doing so successfully, we ask, if their goods were saddled with such import duties as British manufactures have to bear before they can reach the American consumer?"

MOORE'S PULLEY BLOCK.

We annex an illustration of Moore's 7½ tun pulley blocks, with which two men can lift a load of 8 tuns. It represents a front view of the apparatus showing the internal gearing, which is of 20 inches outside diameter. In these blocks two revolving disks are mounted face to face upon a shaft. The meeting face of each disk is dished out, and the periphery of each dished recess is formed into an internal toothed wheel. One disk has a tooth less in number than the other, but both have the same pitch diameter. When the disks are mounted on the shaft, the space formed by the meeting of the two recesses is occupied by a pinion of smaller pitch diameter than that of the internal disk wheels. This pinion is mounted loose upon an eccentric forged in one with the shaft passing through the disks, and is carried round by the revolution of the shaft and eccentric. In revolving, the pinion rolls round the periphery of the internal wheels, and in one complete orbit the faces of the two disks move a distance equal to the pitch of one of the disk teeth, owing to the gradual displacement of the odd tooth. A chain wheel is cast on the back of each disk, and from the cross head and hook to which the weight to be lifted is attached two chains pass, one to the right side and one to the left side of either disk chain wheel. The loose ends pass over and are connected at a convenient distance below the block, forming a loop, which rises as the weight is lowered, and *vice versâ*. The eccentric shaft is made to revolve by a hand chain wheel keyed to it, the wheel being worked by an endless hand chain, and the machine is supported in a frame with a suspending hook at the top, to attach to a beam or other means of support. The differential power is obtained by the gradual displacement of the odd tooth in the revolution of the pinion. The disks are perfectly free to move either way round in the frame, but the weight, coming half on the right side and half on the left, perfectly balances the block and keeps the lifting chain plumb and fair. One advantage of this system, among many which it possesses is that the weight cannot run down when left suspended.



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POWELL'S IMPROVED BURGLAR ALARM.

In the accompanying engraving is represented a new and simple burglar alarm, which may easily be attached to any door. It is so constructed as to be rendered operative or inoperative at will, and is located on the door, shutter, or window, so that a wire inserted from the outside cannot be used as a means of discovering its presence. It presents a neat exterior appearance, as shown in Fig. 1. The rotary parts are exhibited in Fig. 2.

The device consists of a metal box in which is inserted an ordinary clock train, provided with spring, etc., and having the arm, to which the pendulum is usually attached, extending upward and carrying a hammer for striking a gong. Across the frame is a sliding bar, A, the movement of which is limited by a projection passing through a slot made in the direction of its length. This bar, by means of a spring, has a tendency to move inwards or to the right, as placed in the engraving. Connected with the bar is the lower arm of a lever, the upper forked arm of which is adapted to a pin on the arm of another lever. The lever last mentioned comes in contact with the hammer arm, and prevents its vibration when the bar, A, is in the position shown in the engravings. To the end of the bar, A, is attached a catch, B, which hooks over a pin fixed on the door frame when the apparatus is set. On the door being opened, this catch is moved from the pin; and the bar, A, being carried back by the spring, the hammer arm becomes free, and the clockwork causes the bell to sound the alarm.

Fig. 1.

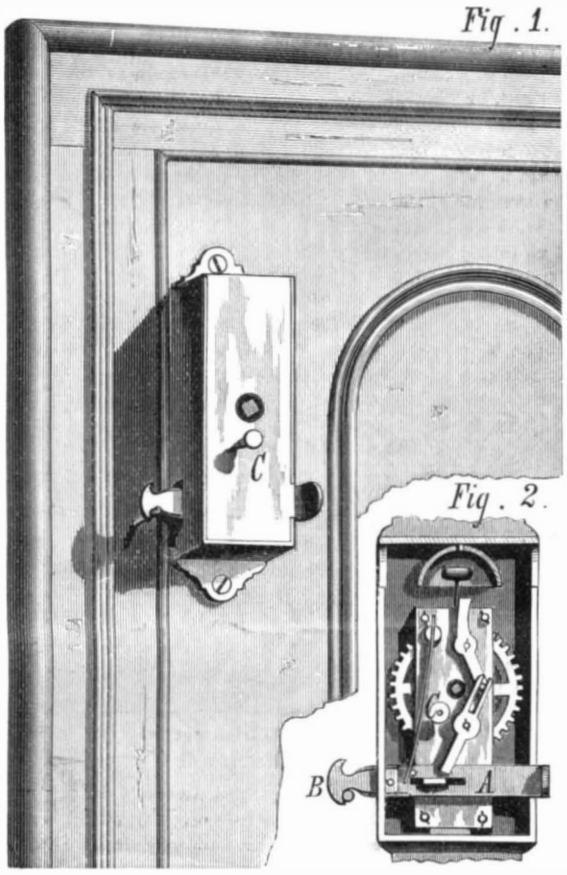


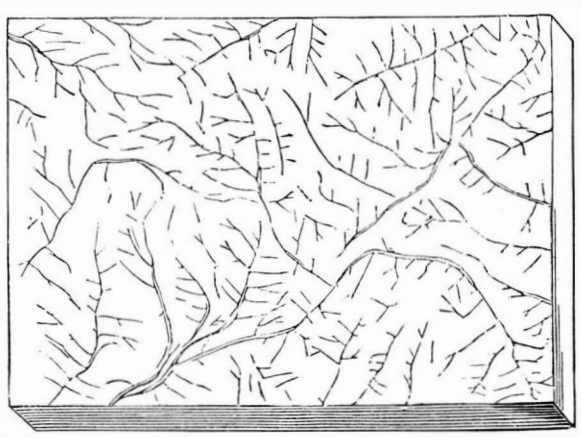
Fig. 2.

When it is desired to hold the alarm out of action, a pin, C, is pushed inward so as to prevent the movement of the escapement arm.

Patented May 18, 1875. For further information, relative to sale of State rights, etc., address the inventor, Mr. Thomas Powell, No. 802 Chesnut street, Philadelphia, Pa.

THE EMISSION OF CARBONIC ACID FROM ROOTS.

It is generally known that leaves decompose carbonic acid when they are exposed to the action of the sun, and disengage carbonic acid when kept in the shade. This is easily proved by simple apparatus, but it is not so readily shown that carbonic acid is emitted from the roots. An interesting experiment, which evidences the latter fact, may be made by means of a slab of polished marble placed a few inches beneath the soil and covered with fine sand. Beans are planted in the sand, in which they will grow well for several weeks. When the plants begin to wither they are pulled up, and the

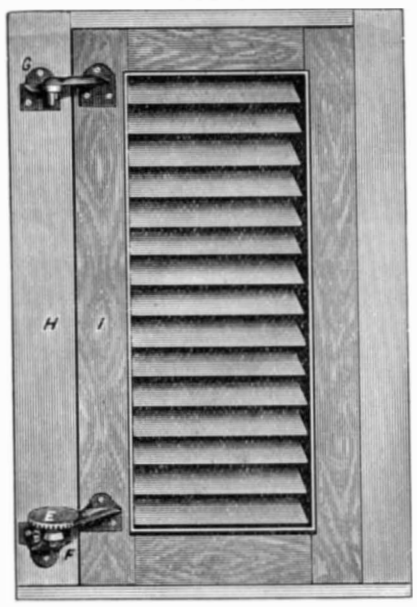


marble plate removed. The surface of the latter over which the roots have run will be found covered with fine grooves, as shewn in the engraving. which indicate the course of the roots. Marble is entirely insoluble in pure water; but like all varieties of carbonate of lime, it is soluble in water charged with carbonic acid, so that the grooves show that the roots must have emitted carbonic acid, which thus acted upon the stone.

THE HOLBROOK PATENT BLIND HINGE.

We illnstrate herewith a novel blind hinge, which is so constructed that by simple mechanism, outside blinds may be closed and opened from the inside, and may be held in any desired position, and all without raising the window. The

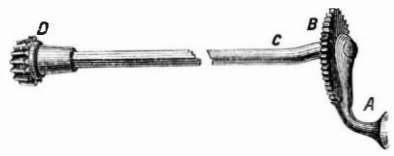
Fig. 1.



device also effectually prevents the blinds' slamming during strong winds, and is well suited for either heavy or light shutters. It will be found without doubt a convenience of importance during the approaching winter, since it admits of greater ease in operating the blinds, and at the same time obviates the necessity of any part of the person being exposed to the cold air.

The apparatus is shown attached to the lower part of the blind in Fig. 1, and in detail in Fig. 2. Referring to the latter figure, C is a rod which extends through the window casing and terminates outside in the pinion, D. This pinion en-

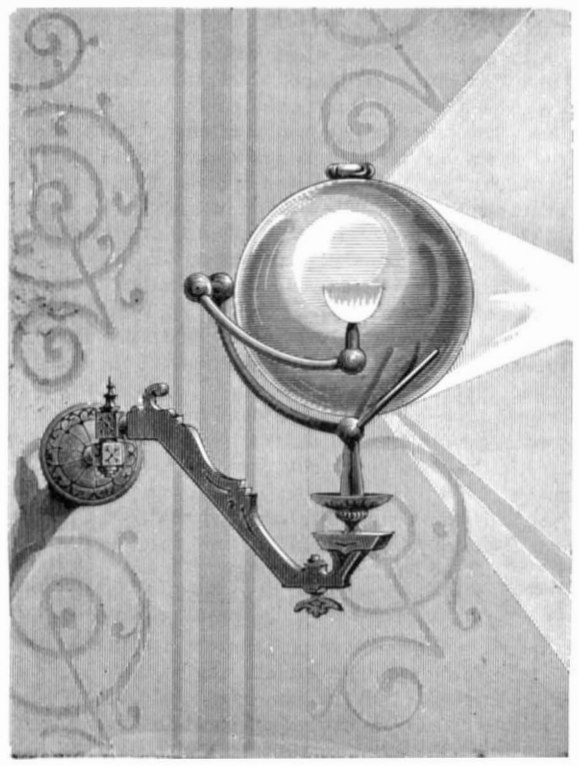
Fig 2.



gages with the crown wheel, E, Fig. 1, which is operated thereby. The rod, C, is turned inside the house by the crank, A, which has a joint motion, and carries a lug on its under side which meshes in the serrated edge of the fixed rosette, B. It will readily be understood that turning rod, C, through the gearing, moves the blind on its hinges; and as the rod, by the means already described, can be held firmly in any position, of course the blind is at the same time secured. The device is durably constructed, and not likely to get out of order. For further information, address the Holbrook Blind Hinge Manufacturing Company, Watertown, N. Y.

MEIGS' IMPROVED DIOPTRIC LIGHT.

The annexed illustration represents a dioptric light, invented and patented by Brevet Major-General M. C. Meigs, Quartermaster General, U.S.A. It consists of a spherical



lens and adjustable bracket. The lens is hollow and is filled with filtered water or a solution of salts; its diameter, for general purposes, is about six inches. The bracket consists of an ordinary ground burner and socket, the latter joined to the adjustable or swinging arm. The lens is supported at three points, namely, by the lower or stationary half of the swinging arm and by two small supports projecting from the upper part of the socket.

This dioptric light is so simple in its construction that the illustration is about all that is needed to explain it, and this simplicity is an addition to its value as a useful invention. It can be handled by any one without instruction, and there is nothing complicated or intricate in its workings, to increase its liability to getting out of repair.

One such lens, possessing the capacity for adjustment of this apparatus, if placed upon a bracket or candelabrum on the side wall of a room or on the gallery rail of a church or hall, could readily be adjusted to cast its beam of light upon the reading desk of the preacher or lecturer, and thus enable him to dispense with lights about the desk on chandeliers above or in front of him, which are so fatiguing to the eyes of the audience. The lens condenses the light directly upon the object; and several such lights and lenses may be mounted upon brackets or chandeliers, and so adjusted as to concentrate their rays upon any book, map, picture, diagram, or piece of apparatus which it may be desired to strongly illuminate.

Messrs. Baker, Arnold & Co., and Cornelius & Sons, of Philadelphia, are General Meigs' principal agents for the sale of the dioptric light.

PEDDEN'S IMPROVED COW TAIL HOLDER.

In the annexed engravings is represented a handy little device, designed for the convenience of farmers and dairymen. Its object is to prevent the cow switching her tail during the operation of milking, thus rendering the process of milking less fatiguing in the fly season, and the likelihood of spilling the milk less frequent. Dairymen, we believe, avoid this trouble, in a measure, by fastening the tail to one hind leg by a bit of string; but this is a rather primitive and certainly unhandy device, for which the present invention will serve as a substitute.

Fig. 1.

Fig. 2.

The attachment, which is represented plainly in Fig. 2, consists of a short bar of metal, on each end of which is cast one of the stationary jaws which, with movable jaws pivoted at the ends of their shanks to said bar, form, when closed together, rings, A and B, of different sizes. The jaws are held together and the rings thus closed by collars, C, which are forced outward by the spiral spring, encircling the bar. To use the device, the smaller ring, A, is opened and sprung around the cow's tail just above the switch; the larger ring is similarly attached to the gambrel of the leg, the whole being disposed as indicated in Fig. 1. It will be seen that the invention holds the tail firmly, while it can very easily be slipped on or off. The inventor assures us that it occasions no annoyance to the cow.

Patent now pending. For further information regarding sale of invention or of rights, address the inventor, Mr. Thomas Pedden, Middletown, Conn.

The Brayton Oil Engine.

The Brayton gas engine, a motor driven by the combustion of ordinary street gas mingled with air, and now quite well known to engineers, has been made the basis of another invention of somewhat similar nature, in which the motive power is furnished by burning a mixture of crude petroleum vapor and air. The oil engine, as far as we have been able to learn, and judging from our own brief inspection of its workings, bids fair to be a successful machine, and one of considerable utility to those who require light power but who wish to avoid the inconveniences of steam. The engine which we saw in operation was alleged to be of 5 horse power, and served to run a variety of metal-working machine tools.

The expense of its working, we were told, was only the cost of five gallons of crude petroleum per day, averaging some forty cents. At a future time we hope to go into the construction of the apparatus more fully; our limited space enables us to give but brief notice this week. A small pump lifts the petroleum directly from the barrel to the cylinder. An air pump compresses air into a reservoir at the lower part of the machine. The air current passes to the cylinder, and in suitable proportion mingles with the oil, which is introduced in the form of spray. The mixture, by a small flame which is constantly maintained, becomes ignited, expands, and so acts upon the piston.

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Correspondence.

The Electric Light and Heat.

To the Editor of the Scientific American:

There is perhaps no more curious phenomenon in electricity than the heating of the conductor by the electric force. The fluid theory clearly falls far short of a reasonable hypothesis, for the reason that the so-called electric fluid must be imponderable, and the imponderable is capable neither of combustion, nor of friction, nor of chemical action, nor of affecting ponderability or matter, some one of which functions is requisite to any production of heat, simply because an imponderable is nothing at all—imponderability having no existence. The theories of Ampère, De la Rive, and others practically resolve the electric force into an imponderable something, separate from and which affects the atomic particles of matter, and its propagation into an interchangeability of the polarities of the imponderability upon the faces of atomic particles.

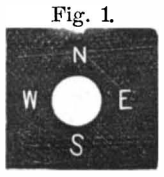
Ten cups of a Grove or carbon battery will instantly heat a fine platinum wire to redness, and instantly melt a lead wire of the same fineness. Nearly twenty cups will be required to raise an iron wire of the same fineness in the same time to the same degree of heat; about eighty cups, a gold wire; in the neighborhood of one hundred cups, a copper wire; and almost one hundred and twenty cups, a silver wire: the capacity of the several metals to propagate the electric force being about as follows, the comparison being with platinum indicated as a unit: Platinum, 1, lead, 1·1; iron, 1·5; gold, 8; copper, 11·5; silver, 12.

It will thus be understood that, as silver is about twelve times as good a conductor as platinum, it requires about twelve times as much battery force to raise it to a given temperature as it does to raise platinum to that temperature.

Assuming that we are in an experimenting room, observing the heating of a platinum wire by the electric force, we comprehend two facts: First, that the heat we witness is not by combustion; second, that there is no chemical action in the wire. These are really important acquisitions of fact, for we are at once brought to the positive conclusion that, as the heat is produced neither by combustion of the wire, nor by chemical action in the wire, it must inevitably be due to friction. To friction of what? Not of "interchanging imponderabilities," or nothings, which can neither themselves exert friction, nor influence matter so as to cause matter to exert friction; but of the motion of one atomic particle of matter with relation to another.

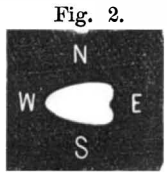
Except very indefinitely, no idea has yet been formulated of the action of a galvanic battery. Perhaps we may determine what that action is, taking as our basis the elements of zinc and a corrosive fluid, which in reality form the battery. It is a mistaken notion that the copper plate is an element of the battery. It in reality serves the same purpose in connecting a wire with the battery that the ground plate sunk into the earth at a telegraph station serves in giving a connection of the line with the earth. It is only necessary that this battery plate shall offer greater resistance to the action of the corrosive fluid than the zinc; and the greater the comparative resistance it offers the greater will be the positive force of the battery; for when the connecting plate is itself attacked by the fluid, it generates a counter electric force in the battery; and if it should be as readily attacked as the zinc, the generated forces would entirely neutralize each other. The copper plate is technically termed the positive or + pole or electrode, and it is in reality the positive electrode, when we consider that the action of the zinc and fluid is to set up repulsory vibration in the direction of the fluid and copper. Taking an atomic particle as naturally a sphere, what do we understand to be its alteration by repulsion?

Fig. 1.



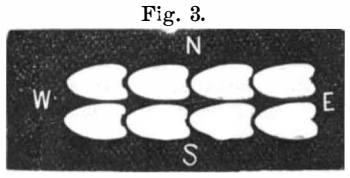
In Fig. 1 the atom is represented as having four cardinal points. Supposing this impact, or repulsion, to be exerted from the zinc electrode at E, the atom being understood as an atom of the corrosive fluid, the sphere would be flattened at that point, and the result, owing to the tenuity of the atom, would be a sort of ellipsoid (see Fig. 2).

Fig. 2.



That is to say, the impact at E would force the interior of the atom in the direction of W. It is obvious that the shape given the atom would be transferred to the next, and so on indefinitely, as also, owing to the cohesion of particles, to those parallel with it (see Fig. 3). So that the shape of the atom at E would

Fig. 3.



be propagated to an indefinite distance, losing force, however, in each successive propagation. I need not point out the fact that such a shaping of the atoms would account for the longitudinal elongation and transverse contraction of a bar of metal through which the electric force is propagated.

What would be the chemical result of such a shaping? The nature of a compound is such that a certain atomic condition is necessary to its becoming or remaining a compound. The change in that condition would of necessity result in decomposition or separation of the elements of the compound, as no two elements of a compound sphere would be capable of assuming precisely the same form, and hence the force of compound atomic cohesion would be nullified. There must be a different action of the atomic particles of matter, in order to produce the observed phenomena, from a mere circular or rotary movement, and something different from a closed circuit around the particles, or an interchanging of polarities of an extraneous imponderability. There must be a shaping of the atomic particles; and reasoning from analogy and the phenomena of repulsion and attraction, we must find in that shaping an approach both to concavity and convexity, concavity at that side of the molecule where the force of repulsion is exerted, and convexity on the opposite side. The concave point is therefore the point of attraction, as the cohesion of particles (supposing that we start from the — pole of a battery to a line of wire with the shape shown in Fig. 4 to the line) would cause the succeeding atoms in the wire to follow the concavity of the primary particle, and so on (see Fig. 5), the atom 1 being the primary atom, and 2 and 3 being the atoms in the line wire. Thus, what is repulsion from one pole of the battery to the wire is attraction from the other pole of the battery to the wire, the action always being from that pole of the battery which is put to the line; otherwise we should have in a line, say between New York and Washington, the following result, if we put at New York the repulsive pole to the wire.

Fig. 4.

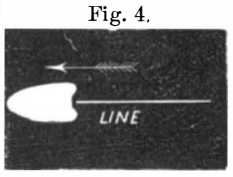


Fig. 5.

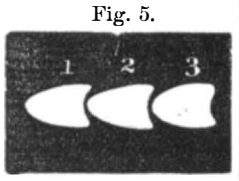
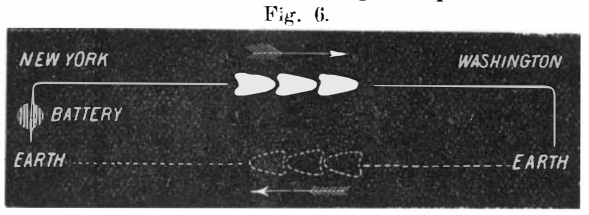
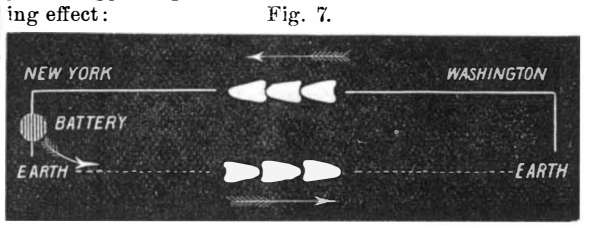


Fig. 6.



In this case the electric force, necessarily starting from the battery by repulsion, would appear at Washington a certain space of time after leaving New York. And if we should put the opposite pole to the line, we would have the following effect:

Fig. 7.



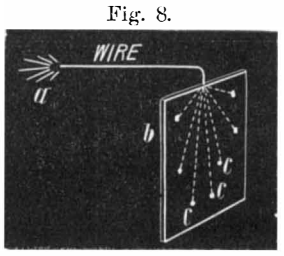
In this case the force would be manifested at Washington by means of the earth connection before appearing at the concavity pole of the battery which is put to the line. All this is assuming that the force is propagated solely by a forward motion or vibration—repulsion.

The clearest way of looking at the question is through the ordinary phenomena of push and traction. A person pushing a bar of metal forward with a certain force is exerting repulsion upon whatever is attached to the other end of the bar; if he draw the bar toward him, he is exerting the force of attraction or traction; in either case a period of time is occupied by the passage or propagation of the force from the person to the other end of the bar; in either case he is really exerting the forces both of repulsion and attraction. He is therefore imparting to the atoms of the bar a polarity positive and negative, so to speak, convex toward himself when he pulls, and concave toward himself when he pushes.

Returning to the galvanic battery, we find that there is a certain surface of zinc subjected to the action of the liquid. A certain number of molecular changes will be set up by this action. The changes must therefore be in the form of a vibration, taking for example a single atom of the metallic elements. The relation between the elements will result in an aggregation of force, which will convert the spherical atom into an ellipsoidal shape, which, immediately after its conversion, will return, or partially return, to its spherical shape. Then another aggregation of energy takes place in the elements, and the atom is again converted into a sort of ellipsoid, and again it becomes a sphere. These successive changes amount practically to a vibration of the atom, spherical to ellipsoidal and return, and spherical to ellipsoidal and return. If this accumulation and conversion were sluggish, there would not be a sufficiently rapid vibration to cause destruction of the force of affinity or cohesion, by which a compound is held a compound, and secure separation of the elements of the compound; but the vibrations of the atoms are so rapid that the force of cohesion, which is neutralized or disrupted by each vibration, is not sufficiently quick in action to restore the condition necessary to preservation of the compound in the time intervening between the electric vibrations; and as a result, the elements are separated, the compound is decomposed. This, I am convinced, is the phenomenon of electrolysis, though I have not space at present to elucidate all the features of the proposition.

It will from the foregoing be understood that a certain surface of elements will evolve so many molecular vibrations per second in the circuit of the elements, and that, however large the surface of the elements may be, these vibrations will be condensed into the connecting conductor. Perhaps this will be clearly comprehended from the following engraving, in which the dots upon the plate are supposed to represent the molecular vibrations set up in the element. The 7 vibrations set up on the plate, *b*, at the points, *c*, are shown by the dotted lines as condensing into the wire, and at the end of the wire, *a*, as distributing therefrom. Assuming that there are 100,000 atomic particles in a diametric atomic division of a No. 20 wire, and that the number of vibrations generated upon the surfaces of the elements of a single cell of battery is 10,000,000 per second: there will, theoretically, either be 100 vibrations per second of each atomic particle of the wire represented in force as 100,000, or 10,000,000 vibrations of each atomic particle represented in force as 1, which latter is doubtless the more correct assumption. Now as we increase the number of cups to 100, we obtain either 1,000,000,000 vibrations per second, or 10,000 vibrations of each atomic particle per second, or we obtain 100 times the force of vibration of each atomic particle. Supposing that we place in this wire a section of finer wire, in which there are but 100 atomic particles in a diametric division, it is obvious that the sphero-ellipsoidal vibrations of each atomic particle in this finer wire will be either 10,000,000 per second, or that the force of vibration will be increased 1,000 times. Though I have given no adequate idea of the vibrations generated by such a battery surface in a second, or of the number of molecules of matter in the atomic diametric division of a given wire, is it wonderful—is it not rather a simple and forcible comprehension—that this vast number of vibrations of the atomic particles per second, this inconceivably rapid impact or friction of one atom of matter upon another, should develop the intense heat we observe in electricity, or the violent detonations and disruptions of the metallic conductor? This is the only explanation of the electric heat, and we now perceive why it is that this intensest of heats may be produced without combustion.

Fig. 8.



I have said that I have given no idea of the rapidity of the electric vibrations. The electric force, when undisturbed by a counter force or an electric force of opposing polarity, has a speed of transmission half as great again as the velocity of light, or 288,000 miles per second. It produces not only the most intense heat, but the most intense light; and we have learned that to yield a deep red, the color of lowest pitch, it is necessary that the propagative atom of matter shall vibrate at the rate of 400,000,000,000,000 times a second. The color of highest pitch is deep violet, and the frequency of vibrations necessary to produce this color is 760,000,000,000,000 per second. The electric vibrations, the vibrations of the atomic particles of the conducting wire, which produce the red light, cannot therefore be less in number than the vibrations which are the requisite of the light. We stand amazed in the presence of such a mystery of motion, when each atom in the seemingly silent wire before us is endowed with life, pulsating at the rate of over 400,000,000,000,000 times a second.

I would not have it understood that I offer the exact form of vibration of the atomic particles, indicated in the engravings, as the absolutely settled actual form. Further research may modify the form somewhat; but we can accept it as a determined fact that it is a motion or vibration of the atomic particles in a conductor, themselves, and not an extraneous thing influencing the atoms, that yields the phenomena of the electric heat and light.

W. E. SAWYER.

New York city.

Skinning a Rhinoceros.

To the Editor of the Scientific American:

On October 14 last, the rhinoceros and cage belonging to Adam Forepaugh's menagerie, while crossing a bridge about 10 miles from Schenectady, N. Y., suddenly broke through, falling about 12 feet upon a hard bottom beneath. The weight of the animal was 4,200 lbs. and of the cage about 4,000 more, making a total weight of over 4 tuns, which proved too much for the structure, which under ordinary circumstances was of sufficient strength. The cage had been drawn through the country by six pairs of large horses; and at the time of the accident, it had gone about half-way across, when the bridge gave way in the center and went down with a crash. The hind wheels going down first, the cage struck with great violence on the rear end.

The driver and horses escaped, strange to say, without accident. The animal struck with great force on his rump, demolishing the end of the cage. By great efforts the cage was extricated by ropes and pulleys from its unfortunate position, when it was found that its inhabitant was much the worse for the fall, having broken his back. He was taken a few miles from the place of the accident, and removed from the cage to a shed near the public road, where he lived a few days and died from the effects of his injuries. He was comparatively a young animal (about six years old), and had not at the time of the accident attained full growth. He was valued at about $8,000 previous to the accident. Parties interested in the New York State Museum of Natural History, at Albany, N. Y., at once set to work to secure the remains of the late rhinoceros for their already valuable museum; and after great effort they succeeded.

Those who have made natural history or dermatology a study are probably aware that the skin of a rhinoceros has an interesting feature which none but a close observer would detect. About the forelegs and partly on the sides of the animal are seen innumerable cracks or fissures in the skin, some of them nearly half an inch deep, running in every direction without any apparent regard to regularity; but upon closer inspection, the skin is found to be formed like a piece of mosaic work, laid out in pentagons. This peculiar feature of the skin is also noticed in some of the other animals, as the armadillo and a few others, and is best seen in the young animals. As they grow old, these lines of demarcation become obliterated. In the animal under consideration, they were shown very visibly. His teeth were all perfect and bones fully ossified; and upon the whole he was considered by a competent judge to be a great prize. Sixty hours after his demise, active operations were begun to divest the animal of that portion of his body which could not possibly be of any

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further service to him, to wit, his skin. The operation was skillfully planned by Professor Ward of Rochester, N. Y. assisted by Professor Lintner, the entomologist, Professor Hall the geologist, of the State Museum, and the writer of this article. Professor Ward who had done similar operations for elephants, hippopotamuses, whales, etc., converted this apparently formidable undertaking into a comparatively simple one. The rhinoceros carcass was first turned over squarely on its back, and maintained in that position by pieces of timber placed on either side. A longitudinal incision was then made, beginning at the lower lip and extending back to the tail. Then there were transverse incisions made, running up the inside of the leg. The skin was then pulled off, working downwards on both sides. The legs were disarticulated at the lower joints, leaving the feet on with the skin. The skin in some places where we made our incisions was fully an inch thick, and very tough, like cartilage. The greatest difficulty was experienced about the head. To peel off the thick clumsy skin from the head, without cutting it, proved rather tedious, especially so about the base of the horn. The horn is not attached, as might be supposed, to the bone beneath by an osseous union, but is merely a protuberance from the skin. Directly underneath it is a plate of bone, supported by elastic tissue, which yields like rubber when the animal strikes with his horn: otherwise he might render himself *hors du combat* by the concussion of the blow intended for his victim. This protuberance, though called horn, is found, when examined microscopically, to be made up of a mass of hairs, agglutinated and conglomerated, thrown out from a thick black basic membrane, from which the horn grows.

Six hours' hard work sufficed to complete our undertaking. The estimated weight of the skin was 300 lbs. It was at once boxed and shipped to Rochester, N. Y. with all despatch, where it is to be tanned and prepared for mounting or stuffing. Several months will elapse before this process will be completed. The reason of the great haste in getting the skin up to Rochester was that signs of decomposition in the structure of the skin had already made their appearance, though the viscera had not yet lost their natural heat. I have since examined at my leisure some of the blood of the animal, with the microscope, with particular reference to the size and shape of the blood globules. I find that they are not any larger than those of the human species; but as to their shape, I am not quite sure whether they are pentagonal or globular. I certainly have noticed among them well marked pentagons, while others were either globular or amorphous. Perhaps this variation in their appearance may be due to putrefactive changes, already in operation in the substance and structure of the blood globule. The flesh was removed from the bones, which were unjointed and also shipped to Rochester. It will require necessarily more time to prepare the bones than the skin. Probably a year will elapse before they are ready for the museum.

Schenectady, N. Y. M. G. PLANCK.

The Protection of Woodwork, etc.

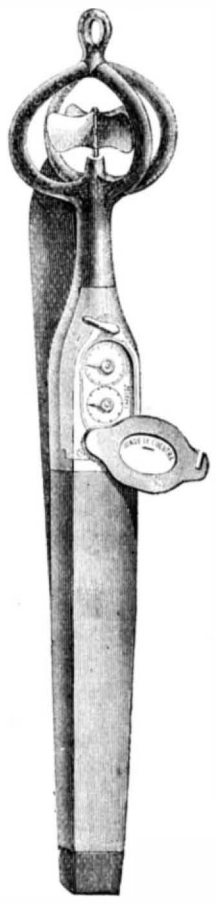
For the benefit of those who are concerned in wooden erections and preservation of timber, we here condense from the *Building News* some useful notes upon the subject. The woodwork we most require to protect is that exposed to alternation of dryness and motsture, such as our external architectural woodwork is. One of the safest remedies is to fill up all cracks with white lead ground in oil, or oil putty, before pointing. A sprinkling of fine sand over the paint while in a wet state has been used sometimes with capital effect, and we have had large boards, wooden cupolas, and wooden casements treated in this way. The sand renders the paint more durable. A paint made of subsulphate of iron, ground up with any oil and thinned with coal tar oil and a little pitch, is recommended. Coal tar and vegetable tar, obtained from pine timber, mixed with dry chalk, is also a good protective. Linseed oil and tar, in equal parts, boiled together and used while hot, after being scorched over by wood burnt under it, strikes into the wood, closes the pores, and makes an impermeable covering. For fences and rough wood, coal tar sanded over is recommended.

To prevent rot, nothing is better than a thorough seasoning, with proper ventilation. Charring timber, or creosoting it, will do much to arrest decay; but when once the dry-rot is found, a cure becomes necessary if we cannot remove or replace with new. A pure solution of corrosive sublimate in water, in the proportion of an ounce to a gallon, used hot, is an effective remedy. A solution of sulphate of copper, ½ lb. to a gallon of water, laid on hot, is recommended as another cure. Paraffin oil, or the cheapest naphtha oil, will stay the decay.

As preventives against marine attacks, coal tar, applied alone, or after a saturation of corrosive sublimate, has been effective in checking worms; also a mixture of lime, sulphur, and colocynth with pitch. To prevent worms in timber, an infusion of quassia is found to be an antidote, anything bitter being antagonistic to animal life. Creosoting is one of the best preventives, however, where it can be used. For articles of furniture a good coating with copal varnish in linseed oil is a method we can safely recommend. Even for external woodwork of ornamental kind, as gable boards and carved work, if the wood is properly seasoned, it is to be preferred to painting. Other insects, such as ants, infest woodwork in new houses. In larders and pantries they are particularly troublesome, frequently getting into preserves, under the crust of pastry, and into anything of a sweet taste. We may here specify a few of the remedies for this kind of pest: Corrosive sublimate, all essential oils, Bethell's process, powdered borax, petroleum oil, camphor, and creosote. The objection to the first cure is that it is a poison; but the other materials are almost as effectual, and can be easily applied. Sometimes, however, it is not desirable to wash or sprinkle our finer woodwork, such as carvings; and it is necessary to have recourse to another process to destroy worms in such work. We are repeatedly asked for recipes for this purpose, and we have given one or two remedies of a simple kind. One of the best modes is to fumigate the carvings or furniture with benzine. This may be done by enclosing the articles in airtight cases or small closets, and then subjecting them to the vapor of benzine, which penetrates the wood deeply. Sponge saturated with the benzine and placed in saucers is the simplest manner of fumigating. The fumes of chloroform have also been found destructive. Or the carvings may be saturated with a strong solution of corrosive sublimate, and afterwards varnished if thought desirable. (Probably the simplest plan is to immerse the article bodily in a bath of naphtha, as recently described in these columns. —EDS. SCI. AM.)

But the fundamental philosophy of the whole question of timber preservation lies in a nutshell. It is the evaporation of the juices and moisture—in one word, seasoning; after which it is only necessary to render wood exposed to wet impervious to it. Ventilation is more of a cure than a preventive, for thorough seasoning includes ventilation, and renders it less necessary; yet it is a precaution, and a very wise one. For wood not exposed, it is far better to leave it alone, or simply varnish it when quite dry.

LE COENTRE'S SOUNDING APPARATUS.



This new sounding apparatus, now supplied under government regulation to all French vessels of war, is illustrated in the accompanying engraving. It is very simple in construction, being nothing more than a small set of blades similar to those of a screw propeller, secured to a vertical shaft. These blades, as the apparatus descends, rotate the shaft, and the number of revolutions are registered by suitable dials in connection with simple transmitting mechanism. The lower part of the device is of lead of the usual weight for deep sea sounding. The principal advantage of the invention lies in the fact of its being indifferent to submarine currents or to rough seas. The blades are rotated only by its downward movement; and of course the more rotations registered, the deeper must be the water. The dials show the depth in meters.

Belting vs. Frictional Gearing.

In the early part of 1872, we published a series of carefully prepared papers on frictional gearing, giving results of experiments therewith, made to determine the percentage of adhesive force or traction of these wheels as compared with belted pulleys. From these tests it appears that the traction of the friction wheels was greater than that of the belted pulleys, and considerably more than is usually supposed to be obtained from belts upon pulleys of either wood or iron; and that, while there is a marked falling off in the adhesion of the belt as the work increases, that of the friction gear increases as the labor becomes greater.

We have lately received a letter from Messrs. Brownlee & Co., of Havelock, Marlborough, New Zealand, which details results considerably at variance with those above noted. Our correspondents say: "We had prepared plans for a sawmill, to be driven by friction instead of by belting; but before ordering machinery, we came to the conclusion we had better make a trial on the same principles as set forth in the SCIENTIFIC AMERICAN" (alluding to the records of the tests given in the series of articles above referred to), "and obtained the following results, which rather staggered us: "Instead of a 6 inch belt, we used a 3½ inch on 17 inch pulleys. The belt without slip showed that 136 lbs. raised 70 lbs.; 320 lbs. raised 153 lbs. Friction gearing without slip, 136 lbs. raised 57 lbs.; 190 lbs. raised 54 lbs.; and 320 lbs. raised 84 lbs."

These last results, though not wholly in accordance with those given by the writer who communicated the articles, are reasonably near; but those given by the belting certainly are wholly out of proportion. Messrs. Brownlee & Co. say that they tried the friction gearing with one half the face, namely, 1¾ inches, and obtained the same result, that is, the same weight was raised.

This is an interesting question of practice, and probably some of our practical readers can throw some light on the wide discrepancy noted. We should very much like to hear, from mechanics who have tested the relative efficiency of belt pulley and friction gear, their views on the subject.

To rivet cold metal, use a ball-pened hammer.

Useful Recipes for the Shop, the Household, and the Farm.

The relative adhesion of nails in the same wood, driven transversely and longitudinally, is as 100 to 78, or about 4 to 3, in dry elm, and 2 to 3 in deal.

A quick method of screwing bolts that have been put in the lathe is to make two deep cuts along them with the screwing tool, as usual. Then take them to the vise, and with a wrench wind them through a solid die. They will thus be cut as true as though finished in the lathe, and all will be of one size, while at least one half the time will be saved.

To cut off the ends of bolts that were too long and have been turned down: Fasten a chisel in the vise with the cutting edge upwards, and rest thereon the end of the bolt to be cut off; then apply another chisel on the top of the bolt end, and strike as usual with the hammer.

Brass piston rings should have the split sufficiently wide to allow for expansion when hot; otherwise they will expand sufficiently to close up the split and bind in the cylinder thus causing them to cut, or become cut by, the cylinder. The same rule applies to brass piston heads.

Short screws or screws of small diameter, such as are usually cut by screw plates, should be cut as follows: Turn the screws as much too long as the thickness of the screw plate; then, for a distance from the end equal to the thickness of the screw plate, turn down the end of the screw so that it will nearly enter the screw plate without having any thread cut on it; and when the screw plate is applied to cut the thread, the reduced piece on the end will serveas a guide, keeping the screw plate true. The screw will fit down evenly all round the underneath face of the head. This method is much more rapid and as true as that of finishing the threads in the lathe.

Piston rings should be turned inside as well as outside, or that they will not spring out of true when they are split. The time required to turn them inside is not one tenth past of that required to true them in the vise, if they warp from being split.

W. S. G. says: When boils make their appearance, take a teaspoonful of soda in a glass of milk every morning and evening.

G. M. G. says: "To renovate oil cloths, dissolve 2½ lbs. paraffin and 1 gallon oil of turpentine by the aid of a gentle heat, and apply with a sponge or piece of flannel, while warm. Let it remain on the oil cloth 24 hours; then polish with flannel. This solution not only renovates but preserves the cloth. I have used it on oil cloths which have been down 4 years, and they look as good as new. The same preparation may also be used on painted floors. When rubbed with flannel, it will have a beautiful gloss, equal to varnish."

W. L. T. says: To cleanse articles from tar, rosin, or any compounds of a resinous character, the use of flaxseed meal, moistened with water, is recommended.

A Plea for the Wild Elephants.

A correspondent of *Land and Water* calls attention to the slaughter of elephants, arranged to take place at Trincomalee, in Ceylon, on the occasion of the Prince's visit. The elephants are described as roaming about in large herds in the most tame and inoffensive fashion, almost heedless of man, for none have been shot for upwards of twelve months. There is at present such a large class of society in England, who advocate kindness to animals in all its forms, that we venture to predict that, when the battue and shooting down of these semi-tame elephants occurs, the accounts will be received in England by the humane and thoughtful portion of the community with feelings the reverse of satisfactory. It seems a pity to destroy, for the sake of simple sport, such useful intelligent animals as elephants. In destroying tigers and other strictly wild and destructive beasts, the sportsmen perform a public service, and this knowledge doubtless adds additional zest to the enterprise; but the wholesale destruction of these huge and valuable assistants to man, on the plea of sport, when their hunting and capture for domestication would be equally exciting and far more instructive, is a proceeding repugnant alike to the teachings of our flag, and to our humane ideas of advanced civilization. If the risk of life from the furious charge of a wounded bull elephant is required to establish the courage of their future king in the eyes of his Eastern Empire, let some other plan be devised, and let his millions of half civilized subjects practically associate his visit with recollections of mercy rather than with the wanton slaughter of animals almost idolized for their utility, and tractability—the most powerful, and yet the most docile, creatures in the universe. Wanton waste brings woeful want. The commercial loss, though large, in an elephant battue is not of so much consequence as the example. The wanton slaughter of buffaloes of late years on the American prairies, and of moose deer in Canada, has already excited the action of their respective Governments, and nearly every State of the Union has been compelled to pass severe repressive game laws to prevent the extermination of many of the indigenous birds and beasts, and this, too, in a wild country with almost unlimited range. We trust to hear that the royal party will have plenty of sport in every legitimate sense, but elephant battues are not legitimate sport. Sport is a misnomer: it is simple butchery.

THE British Admiralty having decided upon the construction of two despatch vessels to be made entirely of steel, the order for the plates and bars for the same has been given to the Landore Siemens Steel Company, of Swansea, who undertake to supply a very mild steel of high quality.

M. SEBILLE, a French architect, injects bricks with tar and finds them impermeable to humidity

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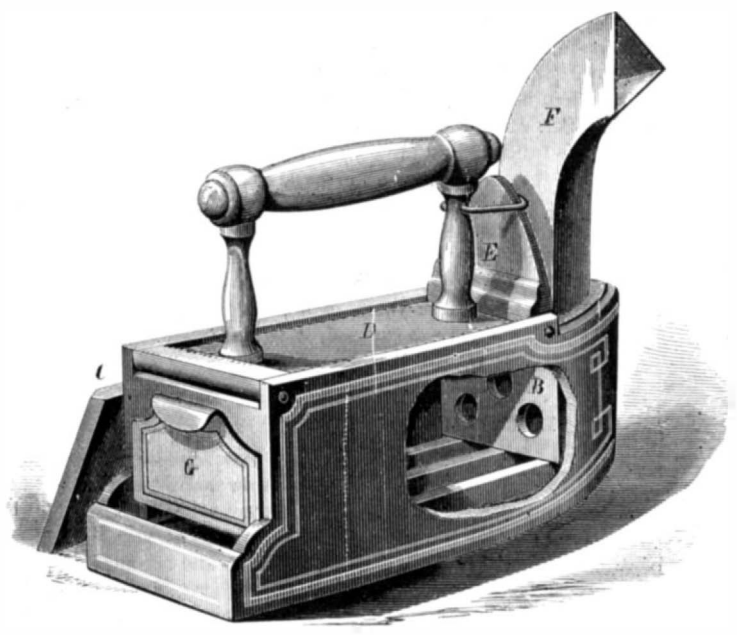
IMPROVED SADIRON.

In the accompanying engraving is represented a new sadiron, which is heated by fire placed within it. Devices are provided for regulating and maintaining a draft and for keeping the smoothing plate at a uniform heat. By this arrangement the frequent warming of the implement is avoided, and time and labor thus economized. As shown in the illustration, a portion of the side is broken away in order to exhibit the interior. The bottom plate is made with a rearward extension and an external box or chamber. which prevents the escape of ashes. On the bottom plate is cast a series of longitudinal ribs, between the ends of which and the walls air passages are left. Said ribs prevent the packing of the fuel on the bottom plate, and also serve to increase the draft which traverses the channels between them. They also make a connecting medium between the fire and the bottom plate, so that the latter, even when covered with ashes, is kept at a uniform heat. B is a partition which is inserted in grooves, and which rests on the ribs as shown. It may either be solid, as at C, in which case the draft passes beneath it, and combustion is confined to the under portion of the fuel, or it may be perforated as represented in place, when the draft is augmented, and a greater heat gained.

The lid is made in two sections, the larger of which, D, is hinged or swung on pivots at the rear, so that it may be turned up to give access to the fire chamber. When down, it is held in place by a shoulder on the front section, E. The latter neatly fits over the forward triangular compartment and can also be raised to a vertical position, in which case a flange or shoulder, as shown in the illustration, projects over and holds the section, C. The loop attached to the handle holds the front section in an upright position. F is the chimney, constructed to fit in the forward compartment. It may be inserted or removed as desired in order to increase or diminish the draft. The sliding door, at G, admits of shutting off the air supply, and thus extinguishing the fire.

Patented May 18, 1875. It is desired to sell the patent to the highest bidder, between the present time and the beginning of 1876. For further information address the inventor, Mr. R. H. Hasenritter, Hermann, Gasconade county, Mo.



HASENRITTER'S IMPROVED SADIRON.

THE CENTENNIAL COMBINATION CULINARY APPARATUS.

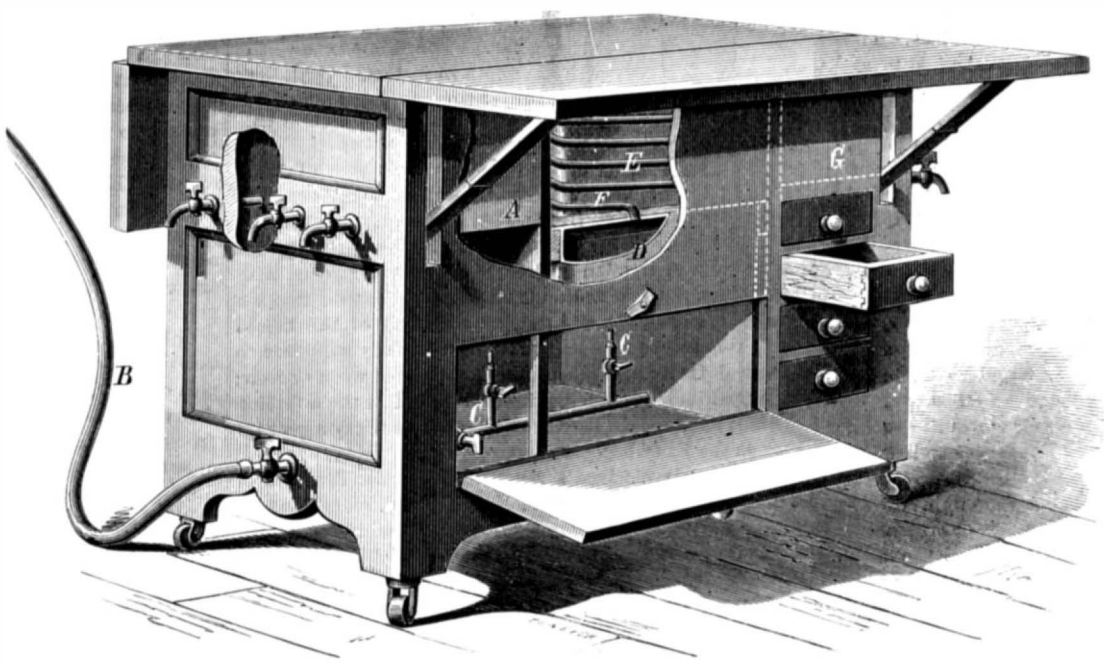
The annexed engraving represents an ingenious piece of furniture in which are combined a variety of articles which we presume were never before brought into such immediate conjunction. In the one device there is an ice box and a heating apparatus, which last may be used for any culinary operation or for clothes boiling. There are several useful drawers, besides a receptacle for a constant hot water supply, while the top may serve as a table. The invention is, in fact, a kitchen in itself, and is well suited for the wants of small families living in limited apartments. It obviates the use of the cooking stove, and thus the heat and expense of the same are avoided. It is compact in size, requiring no more room than an ordinary table, and its construction is quite simple.

The top may be extended by the swinging leaves shown, which are supported by jointed braces. These, when the leaves are not raised, fold back into suitable chambers. At A are arranged tanks for heating water and for preparing tea and coffee. B is a tube which conducts gas to the burners, at C. Instead of gas, kerosene lamps may be used. The heat from either gas or lamps warms water in the tank, D, the steam from which is utilized in the steamer, E, through the lat er having a perforated bottom. From the steamer the steam enters the worm, F, there condenses, and returns to the tank, D, thus securing a constant water supply in the latter, and also being prevented from escaping into the room. Access is given to the fire chamber by the door shown. The ice box, which is located at G, is made with a perforated bottom, so that it can be used for other purposes if desired. The faucet in connection therewith carries off the waste water.

The steamer may be replaced by a sheet iron pan, having apertures for kettles, spiders, etc., or by a pan adapted for holding as many as a dozen flat irons at once, to heat the same. Also a sheet iron oven may be inserted for baking purposes. The condenser can be inserted and used as a wash boiler, in which case the coil, F, will conduct a stream of water upon the clothes, thus cleansing them more quickly and saving in a measure the work of rubbing them. There is also a bread tray and mixer, which can be used for washing dishes. Bread can be set and raised in the coldest weather in the tray, if the latter be kept slightly warm by means of a small lamp or gas flame.

The inventor states that the cost of burning kerosene in his apparatus will not exceed one cent per hour. Of course heat can be generated or extinguished in a few minutes and readily adjusted to any required degree by simply regulating the lamps or gas. The invention may be found useful for camp meetings, picnics, etc., and might prove especially convenient for families who occupy small apartments in Philadelphia during the Centennial.

Patented September 17, 1875. For further information address Mr. A. J. Randall, Belvidere Seminary, Belvidere, N.J.



THE CENTENNIAL COMBINATION CULINARY APPARATUS.

Steam as a Fire Extinguisher.

A remarkable instance of the thorough efficiency of steam as an extinguisher of fire in an enclosed space is afforded by the report of the master of the steamship Petrarch, of Liverpool. The Petrarch was bound from Genoa to Antwerp, with a cargo of sulphur, etc., and after passing Lisbon experienced very severe weather, and at 10 o'clock A.M. was struck by a heavy sea, which threw her on her beam ends. A loud report was then heard from the forehold, and smoke was discovered arising from the ventilators and hatches. The hatches were immediately opened to ascertain the cause, and the cargo was found to be on fire. The vessel was then put before the wind. and the hose laid on, and four feet of water pumped into the hold. The fire, however, increased; and finding water of no avail, the hatches were battened down and steam was turned on at high pressure from the main engine. At 6 A. M. the cargo was still found to be burning; but at 8 A. M. the fire was mastered, and the vessel then proceeded to St. Nazaire, where she arrived in safety. The master attributes the extinction of the fire and the consequent safety of the vessel to the use of the steam jets.—*Nautical Magazine.*

Look Out for the Sewing Machine Monopolists.

It will be remembered that a signal failure attended the efforts of the sewing machine combination to procure the sanction of Congress last winter to an extension of the sewing machine monopoly. We learn that the combination intend to make a vigorous outlay of money during the coming session in the hope of extending another patent, which will have the same effect which the extension of the former patent would have secured. Indeed, it is said that the matter has been so effectually "fixed" that the extension will be renewed without serious opposition.

BRASS wire should be softened before being used for rivets. To soften, heat and allow to cool or dip in water.

Another Rival for Keely.

Still another competitor has made his appearance, and disputes the laurels of the far-famed Keely. Unlike the frank manufacturers of the puzzling apparatus which we illustrate in another column, the new discoverer does not avow his machine to be a trick or clever mechanical problem, but declares it a *bona fide* motor, capable of generating gigantic and colossal power from a ten foot water pressure, and to be operated by mechanism which consists simply of—but that is a secret. The inventor, Mr. Thomas of Chicago, wants to bet Keely $5,000 that his motor will do all Keely's does and that continuously, and in a few weeks he is going to run a large factory with it, and make an improved machine, and get a patent, etc

Inter-Ocean describes the new wonder as follows

"Two cylinders, of cast iron, about twelve inches in diameter and twelve inches deep, with appropriate internal pipes, compose the generator, into which a stream of water is admitted at a pressure of about ten pounds to the square inch, and at a velocity equal to that pressure; in other words, the contents of the generator, which consist of pure water and air, only receive the momentum or energy due to the motion of water under a ten foot head. From the top of each of these cylinders rises a cap or receptacle, similar to the air chamber of an old-fashioned fire engine. From the cap on one of the cylinders, a pipe appears to run to the other cylinder; and from the chamber on top of the second cylinder, a tube connects with the reservoir where the power is stored. The reservoir is of heavy iron, and from the top of it rises a hollow pillar of cast iron, like the cylinder of a steam engine, only, of much greater strength. Within the cylinder which has a bore of about one and one half inches' plays a rod of iron half an inch in diameter. This rod terminates in a solid cap of iron beveled at top to a knife edge, which is crossed by an iron bar about five feet long. This bar acts on the same principle as the lever of a safety valve, the top of the iron rod being the fulcrum, and the weight on the further end of the lever bearing down on the rod with a force equal to 8,000 on the square inch.

"As soon as the stream of water is permitted to flow into the cylinders of the generators, the motive power begins to collect in the reservoir, and, passing up through a check valve in the bottom of the cylinder, which is above the reservoir, forces the iron rod and the lever up to the ceiling; here its upward progress is stayed by the heavy frame work of the building."

The Germination of Seeds.

Some interesting experiments on the growth of seeds have been conducted by M. Uloth. These were undertaken with a view to determine whether seeds could be made to germinate in ice, and the process may be described as follows: Seeds of various species were placed in grooves made in ice cakes, and over the grooved surface other plates of ice were laid, and the whole removed to a cool cellar in January, and there they remained till the following May. An examination then made disclosed the fact that many of the seeds had actually germinated, the roots penetrating into the ice. It is but natural, says *Appleton's Journal*, that facts of this startling character should give rise to controversy, and so we are not surprised to learn that opposite views are entertained as to whence the heat needed for the process of growth was obtained. In the opinion of the experimentor, it was obtained, or rather liberated, in the growth of the roots while forcing themselves into the ice.

From Norway.

One of our subscribers, resident at Flekkefjord, Norway writes us as follows:

At one of the last sittings of the Storthing (the Norwegian parliament) appropriations were made for a general exploration of the waters that lie between the Faroe Islands, Iceland, Spitzbergen, and the coast of Norway. A body of scientific men is to attend the expedition, which is to start in the spring, next year. A steamer is now being fitted out, at Bergen, for the purpose.

"Advices from Hammerfest state that the Swedish polar expedition arrived at the mouth of the Jenisei river on August 15. Four days afterwards Professor Nordenskjöld left the vessel, to return to Stockholm overland. The vessel arrived at Hammerfest on September 26, carrying with her a rich collection of natural history specimens."

THE truest threads in holes are cut from taps having no clearance in the threads. Such taps also cut threads more uniform in size than those having clearance in the thread

THE corners of the square head of a tap should be wel. rounded or chamfered off, so that the wrench will readily adjust itself to the square of the tap.

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IRONCLAD VESSELS.

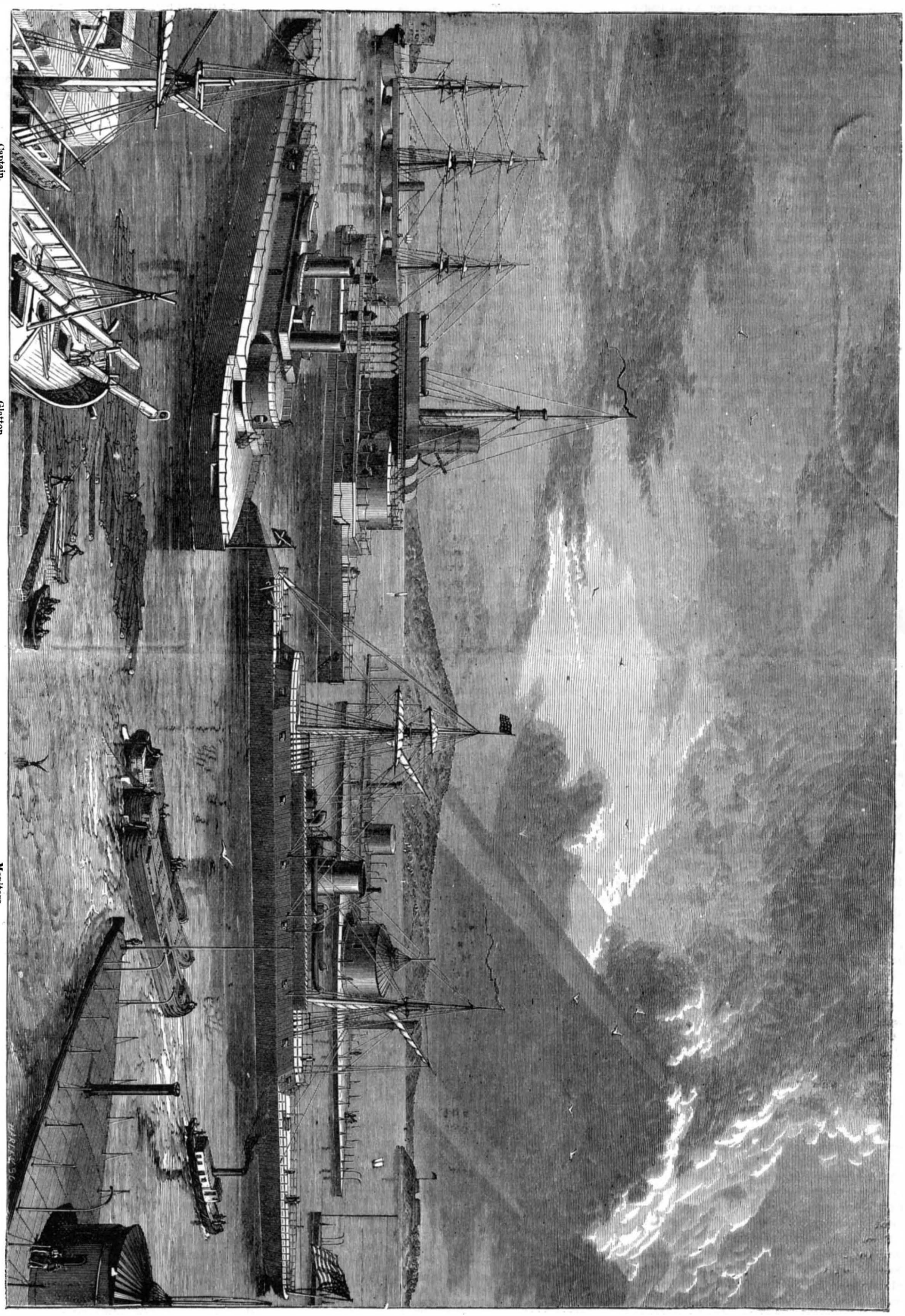
The contest between naval engineers and artillerists has been of long duration, and there seems to be no flagging in the zeal of either party. In the year 1860, France built the first ironclad, *La Gloire*, and her 4½ inch plates were at that time a marvel. Guns capable of piercing this armor at long range were, however, immediately constructed, and since then the rivalry has been unabated. Twenty-four inches thick of rolled iron of the finest quality is now used for protecting the turrets of the most recent naval monsters; and a gun of 81 tuns weight, capable of sending a shot weighing nearly three quarters of a tun through 24 inches of iron and several feet of timber backing, has been constructed as a specimen, and a gun of 120 tuns weight is already talked about. It would seem to be impossible to build a perfectly indestructible vessel; and so far as theory goes, the victory belongs to the artillerists. It must also be remembered that the heavier a ship's plating is, the more certain she is to be a total loss if she once springs a leak. And, on the other hand, the ships can always be armed with guns as powerful as any that can be brought to attack them: but their sea-going capabilities are reduced, and ironclads of the very heaviest armor and armament will probably be used only for coast and harbor defence. In conjunction with a well arranged system of torpedoes, a few turret ships carrying modern artillery could make the approach of an invading army by sea a risk that no enemy would care to encounter.

Our engraving represents three English and two American types of iron-plated vessels, each of which shows a different form of turret. The vessel in the distance on the left is the ill-fated Captain (English) which foundered off Cape Finisterre, France, in July, 1870. She had two large turrets placed amidships, in each of which were two 25-tun rifled guns, capable of throwing 600 lbs. elongated projectiles. In the forecastle and poop were guns of smaller caliber. She was full rigged, and had engines of extraordinary power, and two independent propellers. She carried a crew of 500 men.

The Thunderer is another British vessel, without rigging or masts, and may be better called an engine of war than a ship. Her offensive power is very great, consisting of 32 heavy guns and five of the largest pieces of artillery known at the date of her construction. The ship is handled entirely by steam, and her crew consists of engineers and fighting men. The Glatton is a very formidable vessel, carrying four of the largest guns, mounted in a revolving turret. She also depends on steam for her power of locomotion, and has engine room, magazine, and men's quarters below the water line.

The monitors of the United States Navy are familiar to most of our readers. Probably no ships could possibly be built that would offer less mark for an enemy's artillery, while they can carry guns of immense weight and destruc-

ENGLISH AND AMERICAN IRONCLADS.



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tive power. For river and harbor defence, they seem to be unsurpassable, combining great destructive force with a minimum of liability to danger.

The Dunderberg was a powerful vessel which was protected from the effects of shot by armor placed at an angle pointing seawards from the ship's sides. She was pierced for 20 guns, and mounted 16; and she had a submerged ram which, propelled by her large engines, would be found terribly destructive in action. This vessel occasioned some discussion among naval authorities at the time of her construction, full particulars of which were given in our volume XVII, pages 85 and 115. A description of her trial trip will be found on page 412 of volume XVI. She was designed and contracted for by Mr. W. H. Webb, and built by John Roach & Son; and she was subsequently sold by Mr. Webb to the French overnment.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for December, 1875.

Mercury.

On the 1st of December Mercury rises about 6 A. M., and sets before 4 P. M. On the 31st it rises before 8 A. M., and sets before 5 P. M. It is very small in apparent diameter, and is so nearly in range with the sun after the middle of the month that it cannot be seen.

Venus.

Venus is coming rapidly into better position for observers. On the 1st it rises at 8h. 39m. A. M., and sets about half past 5 P. M. in the southwest. On the 31st, Venus rises a little after 9 in the morning, and sets at 6h. 29m. P. M. It should be looked for as soon as sunset, keeping nearly the path of the sun. It will be small but bright.

Mars.

On the 1st of December, Mars will rise about noon and set at 10h. 27m. P. M. It will be seen on the east of Saturn, having, by its more rapid motion among the stars, passed Saturn, which seems scarcely to change its position from night to night. On the 31st of December, Mars rises about 11 A. M., and sets at 10h. 21m. P. M.

Jupiter.

Jupiter rises at 5h. 23m. A. M., and comes to the meridian at 10h. 20m. in the forenoon, on December 1st, setting at 8h. 22m. P. M. On the 31st, it is little better situated, as it rises at 3h. 55m. A. M., and sets at 1h. 42m. P. M.

Saturn.

Saturn is still easily seen in the early evening on the 1st of December, west of the red planet Mars. It sets on the 1st at 9h. 54m. P. M., and on the 31st at 8h. 9m. P. M.

Uranus.

Uranus is among the small stars of Leo. It rises before Regulus on December 1st at 9h. 50m. P. M., comes to the south at 4h. 47m. in the morning, and sets at 11h. 44m. A. M. It reaches an altitude of 63° 48′ in this latitude, and can be easily found with fixed instruments. On the 31st, it rises at 7h. 49m. P. M., comes to the south at 2h. 47m. in the morning, and sets before 10 A. M.

Neptune.

By an observer who has a meridian instrument, Neptune can be seen as a small star, when it passes the meridian, on the 1st of December at 9h. 15m. P. M., on the 31st at 7h. 15m. P. M. It is among the small stars of *Aries*, and may perhaps be recognized by its motion, although the change of place among the stars is very small,

Occultations.

On the 10th of December, the moon's path will lie among the small stars of the *Pleiades*, and it will pass over or occult some of them by coming between us and their light. As the moon will not be full, and the stars will disappear behind the dark limb of our satellite, the phenomenon is easily seen, can be watched with an opera glass, and affords to the young student an excellent opportunity for learning the moon's rate of motion in orbit. The first occultation occurs about midnight

Sun Spots.

The report is from October 21 to November 16 inclusive. On October 16 the two elongated spots, mentioned in the last report, appeared to have united, and before the next photograph, October 25, had passed off by the motion of the sun on its axis.

On October 25 two large spots, surrounded by penumbra and followed by faculæ, were seen coming on. No change was observed till October 28, when one of the spots seemed to have separated into two; but on October 31, seen through the telescope, these two appeared to have united again.

The photograph of November 3 showed that the two large spots, first observed on October 25, had changed into one huge one; and near the center of the disk, a small spot was seen, which had not been observed before. On November 4 the large spot was seen near the edge, and faculæ were again visible. As this spot probably passed out of sight on November 5, if it returns, it should reappear about November 18, and should be seen to traverse the disk. The small spot, near the center, had changed into two when seen on November 4, and after that date could not be found. From November 5 to November 16 no spots have been seen.

ON the last page of this paper will be found an advertisement of a new recipe book, just published, which will be found useful companion for reference by every one.

Testing the Fatty Oils.

The value of a fatty oil, especially olive oil, as a lubricant depends greatly on the amount of acid in it. The quantity of acid in the oil determines this value not merely on account of its destructive action on the journals and boxes, but because other qualities, such as fluidity, durability, purity in general, and lubricating power, vary with the degree of acidity. Burstyn, chemist in the naval arsenal at Pola, has published a method for determining acidity volumetrically, which has been proved by long experience to be trustworthy In judging of table oils, the process gives a numerical expression for the degree of rancidity, whereby the quality can be measured. The method is as follows: A tall cylindrical vessel, provided with a ground glass stopper and having two marks on it to indicate respectively 100 cubic centimeters (6·1 cubic inches) and 200 cubic centimeters, is filled to the first mark with the oil to be tested and to the second mark with 88 to 90 per cent alcohol. The cylinder is then closed and well shaken. Equal quantities, other than 100 cubic centimeters, can be employed without any other change in the process. After standing 2 or 3 hours, the oil settles, and the clear alcohol, which contains in solution the free acids and a little of the oil, rises to the top perfectly clear; 25 cubic centi meters of the clear alcohol is taken from the top by means of a pipette. A few drops of an alcoholic extract of turmeric is added, and the acid determined by means of a standard solution of potash, as in acetometry. The change from yellow to brownish red takes place with great sharpness when neutralization is reached. The number of cubic centimeters of potash employed multiplied by four gives the quantity of the normal solution requisite to neutralize the free acid in 100 cubic centimeters of oil. As it is not an individual acid but a variable mixture of acids, it is not possible to calculate the percentage of acid present. These numbers, however, may be taken as degrees of acidity. For instance, an oil of three degrees of acidity is one which contains enough free acid to neutralize 3 cubic centimeters of normal alkali.

If we assume that oleic acid predominates, which in most cases is the fact, one degree of acidity corresponds to 0 28 per cent by weight of oleic acid. The olive oil of commerce has an acidity ranging from 0·4° to 12°. The first passes as very fine, and is called free from acid or salad oil, while the latter is known by smell and taste as strongly rancid. Oil that has 4 to 6 degrees of acidity has been found by experiment to answer very well as a lubricator.

What relation there exists between the degree of acidity and an injurious effect upon metals is shown by the following experiments: Four shallow vessels of sheet brass, having a surface of 40 square centimeters (about 6 square inches) each at the bottom, were filled to the depth of 2 millimeters (0·78 inch) with oils of different acidity, and exposed to the air at the ordinary temperature. The vessels were soon more or less covered with green fatty salts, and the oil too acquired a green color. Oil and vessel No. 1 were the only ones in which no change could be perceived. At the end of twelve days, the vessels were cleaned with ether and weighed. The following table shows the amount of action:

Vessel No.	1,	filled with oil of	0·8	degrees,	lost	0·03	grain.
"	" 2	" "	" 4·6	"	"	0 22	grain.
"	" 3	" "	" 7·8	"	"	0·36	grain.
"	" 4	" "	" 8·8	"	"	0·4	grain.

The quantity of metal destroyed in equal times and under equal conditions increases with the acidity of the oil.

This volumetric method of determining the amount of aci extracted from the oil is so simple that a person who is not chemist can with a little practice perform the operation if h can obtain from a chemist the normal potash solution. Ther is, however, a still more simple method, invented by the same person, which depends on the fact that the more acid has been taken up by the alcohol the heavier the latter becomes. It is only necessary to be provided with two cylinders, a sufficient quantity of alcohol, and a delicate hydrometer or alcoholometer. In one cylinder is placed the pure alcohol employed, and its specific gravity is taken; in the second cylinder the oil and alcohol are shaken up together, and when they have separated the hydrometer is transferred to the supernatant alcohol and its specific gravity taken. The greater the difference in the specific gravity found, the larger is the percentage of acid in the oil tested. There must, of course, be alcohol enough above the oil to float the hydrometer without its touching the oil. The hydrometer must be very delicate, so as to read to the fourth decimal place, and the scale need only extend from 0 825 to 0·850.

Burstyn is engaged in preparing a table to show the acidity corresponding to different readings of the hydrometer for alcohol of 88 to 90 per cent when the acidity ranges from 0·5° to 12°. The following table shows a few of his results:

Oil No.	Acidity volumetrically.	Specific gravity of wash alcohol	Specific gravity of clean alcohol employed.
I.	0·8	0.8324	0.8300
II.	2 2	0·8328	"
III.	2·8	0·8330	"
IV.	4 6	0·8336	"
V.	7·8	0·8345	"
VI.	8·8	0·8346	"

If some of our numerous and ingenious Yankee hydrometer makers will put a suitable instrument in the market, with large bulb and short scale, we may soon expect to see this quick and simple method of testing oils introduced into practice. It will not only prove very serviceable to the owner of machinery by easily and quickly informing him whether the oil in question can be used for lubricating, but it will also be useful to dealers and producers, because it enables them to judge, without special difficulty, of the value of their wares, and to know whether the process of refining has gone far enough.

It will scarcely be possible to mix adulterants with the oil so as to conceal the acid and render this test invalid, because the substance added for that purpose must be lighter than alcohol, must be soluble in alcohol as well as in oil, and free from odor, three difficult conditions to fulfil.

Irresolution.

An editorial under the above title, which appeared in a recent issue of the Philadelphia *Ledger*, has attracted our attention as possessing sound reasoning on a very common failing among business people. We make the following extracts:

"There are few conditions of mind more painful to endure, and more fatal to efficiency or success, than irresolution. Most of us can recal occasions when we have been thus afflicted, hesitating anxiously between two opposite courses, preferring first one and then the other, as their several advantages present themselves, becoming each moment more confused and uncertain, and, though vexed and ashamed of the delay, yet utterly unable to end it by a decision. We may be happy, if such a condition is rare and exceptional with us: if our usual habit is to think deliberately, decide resolutely, and act firmly.

"The irresolute man is continually wasting energy. The power that should be economized for action he consumes in anxious alternations of opinion. Does he propose a journey, a business enterprise, or some change in his mode of life, he is torn with conflicting thoughts as to its desirability. The inducements to carry it out appear in glowing colors, and he thinks his purpose is settled; then possibilities of failures and fears of disappointment bear on him so strongly that he almost renounces it. Again convictions of its benefit press with renewed force, and he oscillates most painfully between the two courses, not having sufficient firmness either to undertake or relinquish the enterprise. Meanwhile the delay itself frequently settles the matter: the time in which he might have chosen for himself passes away, and he is forced to accept what fate has left him without any reference to his judgment or preference. Directly the power of choice is removed, all the advantages of the opposite plan rush upon him with tenfold force; he is sure that that would have been his selection had the opportunity been prolonged; and consequently, acting upon compulsion, without heart or faith, and, indeed, against what he now thinks his better judgment, his failure and his discontent are both insured. In the smaller details of life, this irresolution, if less disastrous, is even more vexatious and annoying. To waver about trifles, to hesitate, and doubt, and balance probabilities upon every little matter that presents itself for immediate decision, is a lamentable waste of power, distressing to one's self, and irritating to every looker-on. It is better to make some mistakes, we should all declare, than to thus constantly lose time and force in debating the *pro* and *con* of each petty action.

"A habit of self dependence is one most important ingredient in a resolute character. He who, either from inclination or the force of circumstances, has always leaned upon others, can hardly be expected to show much energy in decisions, or much inflexibility of purpose. It is just here that freedom becomes so palpable a blessing, giving to every man and woman the opportunity for acquiring a self-reliance that nothing else can supply.

"It is perhaps hardly possible for one who has attained maturity with a vacillating, irresolute nature ever to become a decided and resolute character. Still there are various degrees of this valuable quality, and it is within the power of each individual so to discipline himself as to strengthen and increase it. A thoughtful survey of every important subject on which we are called to decide is necessary to this end. There is a time for deliberation as well as for action, and when the former is crowded into the latter a wise decision is impossible. All aids to this end should be warmly welcomed, not as props to support our weakness but as means to correct our judgment. The inflexibility that refuses to receive such aid and only seeks to enforce its own will is obstinacy, not decision. When, however, we have brought all foreign helps into connection with our own judgment, and have thus formed the best conclusion we can in the time allowed, we must, as far as possible, dismiss further consideration and proceed to immediate action. In the less important details of daily life, we shall not greatly err in forcing ourselves to an immediate choice, though we may still question its wisdom. This self-compulsion will be most salutary, especially if we cultivate the habit of revising our actions with a view to avoiding in the future the mistakes into which we may have fallen."

HERR KRUPP, the famous cannon founder of Germany, has just astonished the British Government by a positive refusal to sell one of his great guns to England, remarking that he was willing to contract for the arming of as many forts and ships as England wanted, but he must decline to part with specimens for experimental purposes. "Considering tha Herr Krupp has, in a great measure, learnt the art of big gun making from England," we do not see, says the *Ironmonger*, "why he should be so *krup* when asked, out of compliment, to send one of his big imitations to us."

FOR truing an ordinary oilstone for sharpening planes, take a sheet of glass paper No. 2, and place it on the bench. Rub the stone over it. In this way the stone can be trued in one quarter the time required by the ordinary process.

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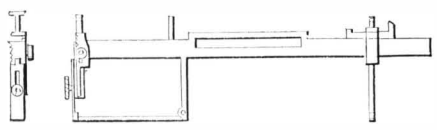
MISCELLANEOUS USEFUL INVENTIONS.

We select this week, from Knight's "Mechanical Dictionary,"* engravings of an interesting series of machines relating to the gaging and setting of axles. We also give illustrations of a variety of baggage checks, from which a good idea of the many ingenious devices, which have been invented for insuring the safety of baggage, may be gathered. Two novel forms of awning, a couple of useful instruments, and some tools complete the list of inventions here presented.

AXLE GAGES

are represented in Figs. 1 and 2. By these implements the spindle is so adjusted in relation to the axletree as to give the required swing and gather. The swing is adjusted to give the downward inclination, and the axle is bent to conform to this guide. The gather is given by the adjustable standard. The swing is the outward inclination of the top of the wheel, and is to meet the requirements of the conical

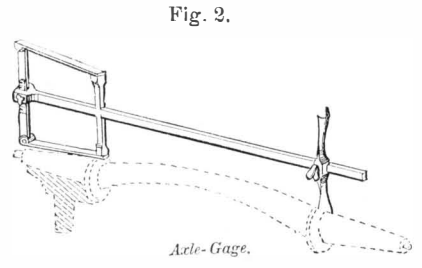
Fig. 1.



Stratton's Axle-Gage.

axle, so that the bottom edge of the spindle shall ride out horizontally. Were the spindle destitute of swing, the wheel would ride outward, bearing heavily against the linch pin or nut. The gather is the forward inclination of the spindle relatively to the general line of direction of the axletree. Fig.

Fig. 2.



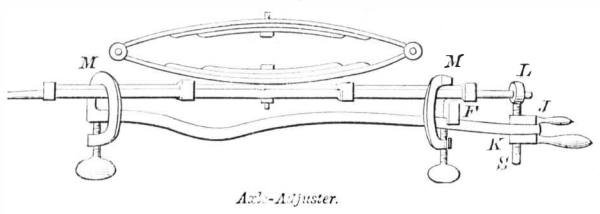
Axle-Gage.

2 shows a gage in which the concave end of the sliding gage is placed on one spindle and the other spindle is set by adjustable bars. The

AXLE SETTING AND ADJUSTING MACHINES

are shown in Figs. 3 and 4. The first is for setting the spindles true on the ends of the axletrees, giving them the required set and gather. The uprights, A C, on the frame, B, are adjustable to any distance. The upright, C, has a jointed

Fig. 4.



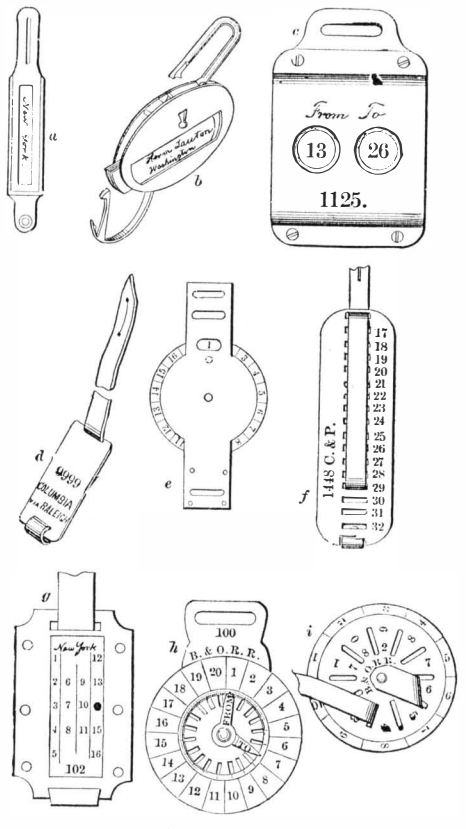
Axle-Adjuster.

bar, D, projecting from it, which rests on a screw rod, E. This bar is a straight edge, to show the taper of the axle; for when the same is placed on the uprights, and the stop, F, brought up to it by the screw, the taper will be given by the gage, G, shown in dotted lines. If the axle does not touch the stop, F, it is too high on the end, and must be brought down by the blacksmith. If it touches at the end and not at the shoulder, it is too low and must be treated accordingly. The axle is then turned end for end, and the operation is repeated. The T end on the frame is to set the T foot of the gage against, as shown. The angle of the gage is obtained by setting the gage foot against the spoke, and putting the straight edge, H, in the axle box, as in the smaller figure. A more portable form of the same general character is shown in the axle adjuster, Fig. 4. It consists of a bar hooked to the axle tree in two places. The bar is fastened by the clamp, M, and fulcrum block, F. The eyebolt is hooked over the end of the spindle, and the adjustment of the latter is accomplished by the screw, S, and set nuts, J K.

BAGGAGE CHECKS.

In Fig. 5, *a* shows a label holder of two metallic portions, which serve as a frame for a card, on which is inscribed the destination. *b* is a lock-up case for several of such cards, any one of which can be exposed as desired. *c* has two series of numbers on wheels, and the places of departure and destination are indicated by numbers agreeing with the schedule of stations. *d* has the places of departure and destination on the sides. Either reading may be hidden by the strap. On the return trip the other side of the check is shown by the inverse reeving of the strap. *e* has a disk with a circumferentially numbered margin. A number agreeing with the schedule number of the station for which the baggage is bound is exposed at the opening on the plate. By an arrangement of the strap, the latter is made to hold the disk so as to secure the required presentation of the figure. *f* has a series of station numbers in a row; the strap is so rove through the slots as to indicate the station (29) at which the baggage is to be put off. *g* is a metallic case inclosing a card with the numbers of the stations printed thereon. A punch mark indicates the station of destination (14 in the engraving). The strap holds the parts of the case together. *h* has a dial plate and pointers, which indicate the stations of

Fig. 5.

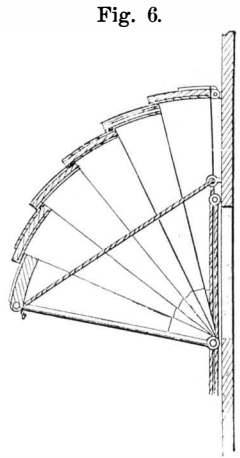


Baggage-Checks.

departure and destination. *i* is a metallic disk with radial slots and corresponding numbers. The strap is so rove through the slots as to give the required indication. The

AWNINGS,

Fig. 6.



Arched Awning.

shown in Figs. 6 and 7, are made in two forms. In Fig. 6 the lower edge is attached to the boards which are secured to the side extensors, which are made in toggle sections, operating as lazy tongs. The upper edge is coiled on a roller held by a pawl. A spiral spring keeps the arm extended. In Fig. 7, front and tapered side slats slide one beneath the other, and are connected by plates with headed studs which work in slotted plates affixed on the adjacent slats. The end slats collect like the folding parts of a fan; the roof slats take position in vertical parallel series when closed. The

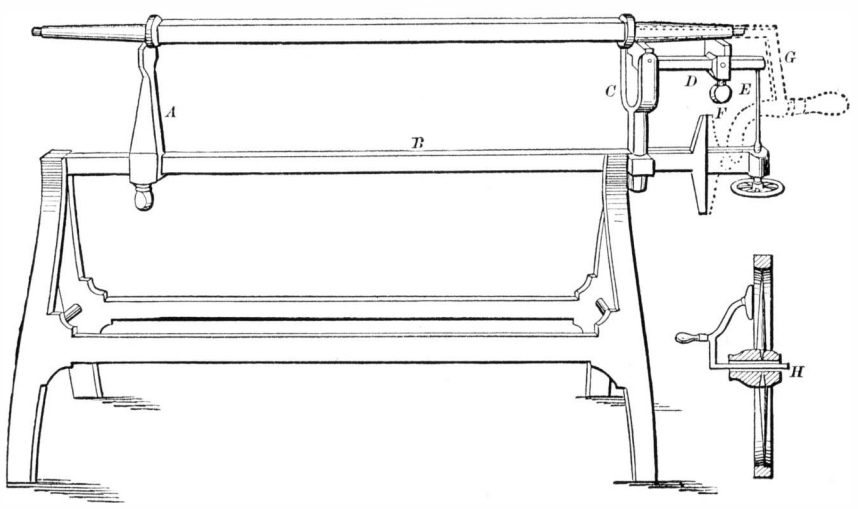
ALLOY BALANCE,

represented in Fig. 8, is intended for weighing those metals whose proportions are stated decimally, being constructed on the principle that weights *in equilibrio* are inversely as their distances from their points of support. The point of suspension, *a*, of the balance is adjusted until the arms are respectively as the two stated proportions, say 17 tin to 83 copper. The half of the beam is divided into 50 equal parts, numbered from one end; and the point of suspension being adjusted proportionally, the weight, *w*, is brought to a position where it enables the beam of the empty balance to stand in equilibrium. A quantity of copper being then placed in the scale suspended from the short arm will be balanced by the proportionate quantity of tin in the other scale.

THE BAROMETROGRAPH.

Fig. 9 is a self-adjusting barometer. The pressure of the atmosphere affects four metallic boxes having undulated faces. In each of these a vacuum exists, and they are attached together, so that, for an equivalent variation of pressure, the movement is four times greater than for one box only. A strong steel spring, R, acts upon the boxes against the atmospheric pressure, and controls the lever, L, at B

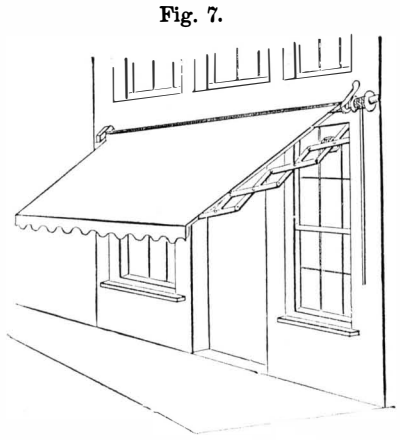
Fig. 3.



Gorton's Axle-setting Machine.

The indications of the lever are registered as follows: A cylinder, C, is revolved by clockwork, and makes one revolution per week. It carries blackened paper, against which the

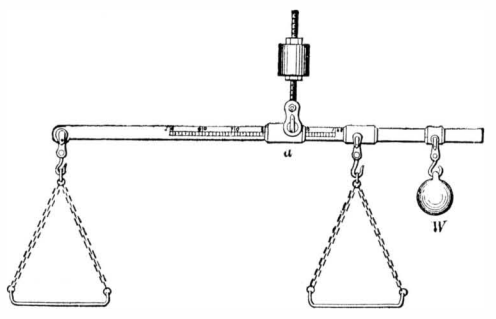
Fig. 7.



Lazy-Tongs-Extension Awning.

point of a spring attached to the lever rests, tracing a white line on a black ground. At the end of each week the paper is changed for a fresh one, the record on the old one being

Fig. 8



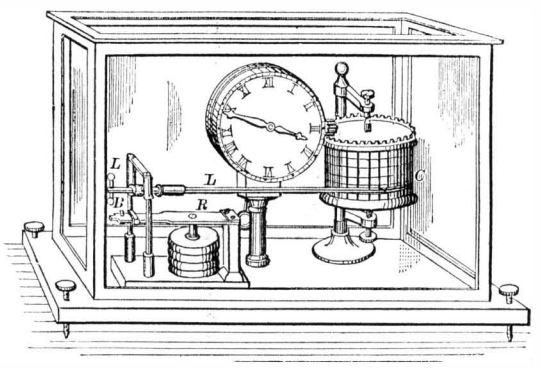
Robert's Alloy Balance.

protected by a coat of varnish.

AWL HANDLES

are represented in Fig. 10. The first is a locking pliers,

Fig. 9.



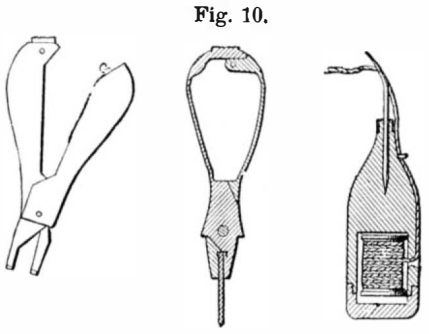
French Barometrograph.

whose jaws are adapted to hold either of the tools; those not in use are inclosed in the hollow handle when the latter is closed. A boss on the end of the handle forms a hammer. The figure shows an elevation open, and a section closed. The eye-pointed awl, also represented, introduces the thread. Fig. 11 is an

AXE TESTER.

The axe to be tested is slipped upon the bar,

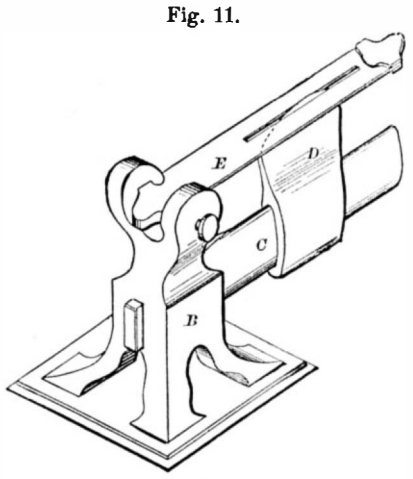
Fig. 10.



Awl-Handle. *Lasting-Awl.*

C, toward the standard, B, until it fits tightly. The gage plate, E, is then allowed to descend upon the edge of the axis, D, when, by placing the eye over the slot, the slightest variation in shape may be detected.

Fig. 11.



Axe-Tester.

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NEW BOOKS AND PUBLICATIONS.

THE NEW METHOD OF GRAPHICAL STATICS. By A. J. Du Bois, C.E., Ph. D. With Sixty Illustrations. New York city: D. Van Nostrand, 26 Murray and 27 Warren streets.

In this book, Dr. Dubois calls the attention of the profession of engineering to the value of the graphic method of solving problems in statics, the study of which will enable the reader to investigate many practical questions. The method is of general application in resolving the direction of forces, and in determining the center of gravity and moment of inertia of areas and solids. The first chapter elucidates Professor Clerk-Maxwell's method of diagrams, found on the parallelogram of forces; and elsewhere in the work, Culmann's method of the equilibrium polygon receives much attention. The subject, however, is a very large one; and although the author states that he does not attempt even to outline its complete development, he has succeeded in giving an interesting presentation of this valuable system of calculation.

THE USE OF STEEL FOR CONSTRUCTIVE PURPOSES: Method of Working, Applying, and Testing Plates and Bars. By J. Barba, Chief Naval Constructor at L'Orient, France. Translated from the French, with a Preface by Alexander L. Holley, C. E. Price $1.50. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

Steel is rapidly superseding iron for all purposes where durability is the chief essential; and the Bessemer and Siemens-Martin processes are giving us steel at an advance on the price of wrought iron which becomes nominal when the superiority of the former metal is taken into consideration. The most important English railroad has for some time built its locomotives of Bessemer steel, the wheels being the only important parts that are made of iron. M. Barba's work contains some very interesting descriptions of war vessels built of steel, especially three large vessels built in 1873 by M. De Bussy, an eminent French naval engineer. The French government, being entirely satisfied with the work, has ordered three more to be forthwith constructed, in which steel will be used for all parts not in direct contact with sea water. The book is an exhaustive treatise on its branch of industrial science, and will deservedly meet with an extensive sale.

THE MAINTENANCE OF HEALTH, a Medical Work for Lay Readers. By J. Milner Fothergill, M.D., M.R.C.P. New York city: G. P. Putnam's Sons, Fourth avenue and 23d street.

This work is one of the most sensible treatises on the subject that we have ever read, and it is almost the only one in which some pet nostrum or wild theory of the author does not find a place. Dr. Fothergill does not deal in panaceas or fanatical ideas as to diet and regimen; but he has succeeded in giving a clear and complete history of all that bears on man's physical well being, and he has done this in a forcible and accurate style. The book deserves to become a standard authority with those who rely on the teachings of Science, while its moderation and good sense will commend it to the many who are nauseated with the flood of quack literature which is annually issued on this subject.

SEWERAGE AND SEWAGE UTILIZATION. By Professor W. H. Corfield, M.A., of the University of London, Author of "Water and Water Supply." Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This excellent and well written treatise is No. 18 of the publisher's "Science Series."

THE ORIGIN OF LIFE AND SPECIES. A New Theory. Pittsfield, Mass.: W. H. Phillips.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COTTON PRESS.

Daniel S. McBryde, Good Hope, Miss.—The object here is to afford simple mechanism and considerable power in direct line. The press consists of longitudinal supporting sills and guide pieces for the rods of the follower blocks, which are moved forward by the gearing of pivoted sector pieces, with eccentric segments of a centrally pivoted lever.

IMPROVED FEED CUTTER.

Robert J. Wylie, Marissa, Ill.—This inventor combines eccentric gearing with the shaft that carries the knife, and with other portions of the machine, so that the construction is simplified and at the same time greater power exerted in operating the knife.

IMPROVED PORTABLE COTTON GINNING, ETC., MACHINE.

Julius L. Toole, Williston, S. C.—This is a portable power apparatus for driving a gin and condenser (also applicable for other purposes). With it the inventor, in an ingenious manner, has combined a gin, also a condenser and a press, which is attached to the machine, so as to receive the cotton from the condenser ready for pressing.

IMPROVED CORN MARKER.

Thomas B. Kirkwood, Bentonville, Ind.—This inventor offers a new and useful agricultural implement, in which a cutter board swinging from the axle carries cutters on its under side. The shovels are centrally slotted and seated over the cutter, and the latter presents the points of the shovels for catching on stones, etc. The guide-marking pole may be swung to either side of the main board without necessitating the detaching of the pole when the guide-marking board is to be used at the opposite side.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMROVEMENT IN MAKING PATTERNS FOR CASTINGS.

William E. Craig, Indianapolis, Ind.—This is a new and doubtless useful idea for making elaborate patterns for ornamental iron work, etc., and one that is calculated to ensure considerable economy in time. The workman first models the form of the article in potter's clay. From this he takes a plaster mold, on which he casts a back mold also in plaster. In the last he casts a pattern made of a composition of beeswax, red lead, and resin. This is put back on the back mold, using it as a follow board, and on it is made another mold from which the sand mold is produced.

IMPROVED CAR COUPLING.

James B. Smith, Hepworth, Canada.—This coupling is so constructed that, when the drawbars approach each other, their front hooks pass alongside of each other, pressing the drawbars sidewise until the hooks strike the side spurs (acting as buffers) back of the same. Guard springs are then called into action, bearing on the drawhead of the opposite coupling, so as to produce the secure interlocking of the hooks, and prevent the uncoupling in connection with the side spurs.

IMPROVED GAS APPARATUS.

Charles Lord and Bernard J. McCabe, Shelbyville, Ind.—These inventors propose a new means for converting crude or refined coal and natural oils into more permanently fixed gas than they can be in the ordinary retorts. The essential novelty is a contrivance by which a clay retort can be used for this purpose without injury by the oils, which, when coming in contact with the clay, saturate and disintegrate it, so as to destroy it in a short time. This is accomplished by first vaporizing the oil in the feed pipe, and then discharging it into the iron retort, where the vaporizing process is continued, so as to destroy the penetrating power, and then discharging it into the clay retort, where it is subjected to greater heat than the metal retorts are capable of sustaining, and is thereby converted into fixed gas. The iron retort is so constructed that any oil that may flow into it cannot escape until it is vaporized.

IMPROVED WATER WHEEL.

Adam W. Haag, Fleetwood, Pa.—In this invention the novel features consist in a spring which throws the points of the gates into notches in guides when they close, to shut said gates tightly; also in cams, contrived to hold the rings and buckets shut; a V-shaped rib, which presses into the flow of the penstock, to pack tight and prevent leakage; and a shaft bearing in two parts, secured together by a ring.

IMPROVED HORSE POWER.

William I. Grant, Magnolia, Ark.—This is a method for attaching the sweeps to the shaft or king post of the ground wheel by a frame attached to arms radiating from the shaft. The sweeps are thus supported on the opposite sides of the shaft at considerable distance therefrom. An increased leverage is obtained, and the king post is made very firm.

IMPROVED PUMP.

William Young, Easton, Pa.—The pump barrel is attached to a vulcanized or galvanized gas pipe, which passes into a base plate and also into the handle bracket, in both of which it is adjustable. A waste valve attached to the pipe is arranged to close by the pressure of water when the pump is working, and is provided with a spring which opens it when the pump stops, thus allowing the water to run out, and so preventing freezing.

IMPROVED TURBINE WHEEL.

Thomas H. Clark, Helena, Montana Ter.—This wheel receives the water horizontally upon the upper part of the buckets, through stationary chutes surrounding the same, and discharges it vertically and rearwardly. The novel features are a vertically adjustable gate with the apparatus for operating it.

IMPROVED LATHE FOR TURNING OVALS.

Louis K. Scotford, Burlingame, Kan.—In this machine, revolving cone pulleys turn on a stationary center, and have a face plate fitted on the face of said center so as to slide freely forward and backward. This slide, which is to carry the work, has a slot which works on a stud, projecting from the stationary center, so that it can be shifted toward and from the axis. This causes the plate to slide, more or less, according to the distance the stud is located from the center. The arrangement is a very simple one for oval turning.

IMPROVED VENTILATING APPARATUS.

John C. Bates, Cold Spring, N. Y.—This inventor proposes an apparatus for ventilating rooms by introducing any desired amount of fresh air in such a way as not to produce a draft, and by which the foul air may be expelled from the room, thus causing a circulation and keeping the room thoroughly ventilated. A horizontal pipe communicating with the outward air has a drum pierced with flues interposed between the register and the hot air flue. The said inlet pipe is combined and communicates with a vertical pipe, which delivers the air into the room in a vertical column far enough above the heads of the occupants to relieve them from the bad effects of a draft.

IMPROVED PARALLEL PLIERS.

Henry R. Russell, Woodbury, N. J., assignor of one half his right to Isaac S. Russell, New Market, Md.—This relates to pliers, vises, etc., in which the jaws are constructed independently of the pivoted handles for working them, and are so pivoted to the handles and provided with guide pins that they always work parallel to each other, while the handles turn on a pivot. The device consists of open-ended grooves in the jaws for the guide pins, so contrived that the guide pins may be permanently fixed in the handles before the jaws are attached, and then be engaged with the jaws when they are applied by sliding into the open-ended grooves. This contrivance allows of fixing the pins in the jaws more permanently than they can well be when the pins have to be put into the handles through slots, and of dressing out the grooves to make them true and smooth by a milling tool.

IMPROVED RAILROAD JOINT.

James G. Holliday, Pittsburgh, Pa., assignor to himself and Frank E. Hutchinson, same place.—This inventor has devised a plate for binding the rails on the ties, arranged under a shoulder of the fish plate, and contrived to form a lock for the nuts.

IMPROVED METAL SHEARS.

Thomas C. Livesay and Henry H. Black, Montana City, Kan.—In this device we have a novel mode of applying the movable and stationary cutters to the bed of a lever-shearing machine. An edge-curved cutter is made fast to and raised diagonally above the bed, and the lever-cutter is pivoted to the bed at one end of the stationary cutter.

IMPROVED BULL WHEEL FOR OIL WELLS.

John Schellkopf, Tidioute, Pa.—This invention relates to the construction of the wheel commonly termed the "bull wheel," used in derricks for oil wells, and around which passes the rope or chain by which the implement used in the well is hoisted out of the same. It is proposed to make the wheel of sections attachable and detachable from each other and the hub or shaft by means of fastening bolts.

IMPROVED CAR VENTILATOR.

Archibald Hance, New York city.—In this device a series of pivoted ventilators or valves are connected at one side by means of a strap, so that they may be operated simultaneously by means of a curved pivoted rack bar. Another (and the main) function of the valve-connecting bar is to act as a stop for the valves when opened.

IMPROVED PUMP BUCKET.

Eugene J. Dunbar, Romulus, Mich.—This is a bucket for suction pumps, so constructed as to fill the cavity of the pump cylinder at each upward stroke, and to open at each downward stroke. The device is made of india-rubber, in cylindrical form, with a bell-shaped cavity in its lower end, and with longitudinal holes through it. There is a conical iron valve, and a rod for limiting the action of the same.

IMPROVED PISTON PACKINGS.

Christopher R. James, Jersey City, N. J.—This inventor proposes a series of packing rings tapered on the inside to correspond with a spring, and so placed that the spring presses them out against the cylinder, and also against the piston and follower, thus tightly packing the joint.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED METHOD OF CONSTRUCTING JAILS.

John A. Seeber and James C. Croxton, Rockwall, Tex.—One of the most important subjects brought to the consideration of the Prison Congresses lately held in England, and to which the Prison Association and other philanthropic bodies are giving much attention in this country, is the proper construction of jails. The present inventors offer a new plan of construction, mainly directed to ensuring good ventilation. The intermediate space of the double floor is constructed with diagonal channels, running from the outer walls to the center of the building, with grated openings in the walls, and similarly grated openings at suitable points of the upper part of the floor. The different compartments are thus supplied continually with fresh air entering from the outside and passing to the inside. The outer walls serve for the purpose of ventilation and security in the same manner as the floors, and are also provided with air flues, having grated entrance and exit openings at different points, for supplying air without the possibility of communication with the outside, so that no tools, etc., can be introduced. The different stories are ventilated in this manner, and the bad air carried out through the grated inside doors.

IMPROVED EAVES TROUGH.

Otis W. Stearns, Johnson, Vt.—This eaves trough may be conveniently put up, and may be made of any desired length. It is formed of semi-cylindrical sections, made with half ring tenons upon their ends, and semi-cylindrical couplings, made with half ring sockets in their edges, and provided with spikes for securing them to the wall.

IMPROVED DUMPING WAGON.

Albert A. Hoch, Reading, Pa.—This is a new form of that class of dumping wagons which are provided with chutes or troughs to facilitate discharge of their contents. The essential features are a hinged door and hinged side guards, arranged and connected with a hinged chute and the wagon body. The whole forms a very simple and doubtless effective device.

IMPROVED WEATHER STRIP.

Francis A. Bradshaw, Lebanon, Mo.—In this we have a weather strip for doors by which no water is allowed between the door and the threshold strip, and the drip water is carried off in effective manner. An adjustable elastic weather strip fits on the threshold strip, that is provided with a groove and outwardly inclined mortises for the drip water. The groove is covered by a perforated metallic plate.

IMPROVED LAMP CHIMNEY.

George M. Bull, New Baltimore, N. Y.—This inventor patented a lamp chimney on January 9, 1872, and now proposes to make it simpler in construction and less expensive. To this end, around the edge of a rectangular plate is formed a narrow upwardly projecting flange, which covers the outer side of the lower end edges of the transparent plates. Plates of thin sheet metal are bent longitudinally at right angles, the lower ends of which fit into the angles of the flanges at the corners of the plate, and are designed to receive the side edges of the transparent plates. The upper ends of the angular strips are inclined inward slightly, giving to the chimney the form of a truncated rectangular pyramid. Novel devices are added to enable the mica plates to be put in and taken out, as may be required.

IMPROVED CRADLE

Fredrick Voit, New York city, assignor to Feust and Rice, of same place.—In this invention the connection of the bed posts with the connecting main frame is made in a strong and substantial manner without the use of fastenings or other hardware, and a rigid interlocking of the parts is obtained, together with an easy detaching of the same.

NEW HOUSEHOLD ARTICLES.

IMPROVED WASHING MACHINE.

John Henry Conaway, Nelsonville, Ohio.—The mechanism of this washing machine is so constructed as to wash the clothes by rubbing them in a manner analogous to hand-rubbing. More or less pressure may be applied to the clothes, as may be required, and any desired part of them may be rubbed.

IMPROVED SASH HOLDER.

Hiram Torrey, Philadelphia, Pa., and Darius Lyman, Washington, D. C.—The invention relates to a device designed for application to a window sash for the purpose of arresting and supporting the same by frictional contact with the jamb. The chief elements of the device are a movable or adjustable elastic wedge, and an elastic roll mounted on a fixed pivot, the former being connected with a pivoted spring lever and so arranged as to adapt it for insertion, between the roll and jamb, to lock the sash.

IMPROVED WASHING MACHINE.

Irvin A. Shaw, Grand Meadow, Minn., assignor to himself and John E. Joslyn, of same place.—This is an ingenious combination of mechanism in which rollers, springs, and an endless apron play the principal part, the effect being that the clothes are alternately drawn through the water, and then between rollers, and are thus washed clean very quickly and without being injured.

IMPROVED KEY HOLE GUARD.

John La Blanc and Xavier St. Pierre, Ophir city, Utah Ter.—In this we have a little plate made to slide over the outside key hole of a lock by a knob on the inside. The knob works the plate by a crank and connecting rod, turning them down below the center of the crank on a stop pin, when the slide covers the hole, so as to effectually prevent the slide from being forced back except by the knob. The sliding cover is secured behind an outer case, so as not to be wrenched off.

IMPROVED WRINGER ATTACHMENT TO WASH TUBS.

Andrew W. Caldwell, Gainesville, Ga.—Laundresses unprovided with mechanical wringers have no easy task in wringing out by hand large articles of clothing, etc. The present inventor suggests an ingenious way of assisting them, which consists in a strap passed through a loop of the tub and easily adapted as to length. By this, one end of the article is tightly held, while the other is twisted in the usual way.

IMPROVED FIRE DOG.

Draton S. Hale, Estillville, Va.—In this invention the fire dogs are so constructed as to keep the fire held up against the back stick. They are made with a wide open hook at their upper ends, and their lower parts are bent downward at right angles, and formed either with or without an offset. Racks are combined with the dogs to hold them in place.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED TAILORS' DRAFTING APPARATUS.

Matthew C. Ten Eyck, St. Paul, Minn.—This is a conformator and transfer or scarf for drafting garments to fit the upper part of the human body, giving the true pitch or slope of the shoulders and the true balance of all other essential points with the same, thereby insuring an accurate fit.

IMPROVED GUN SIGHT.

William M. Treadway, Port Henry, N. Y.—Mr. Treadway suggests that a better aim can be taken with a rifle, and that at the same time the piece may be more accurately kept at the same elevation for every shot, by placing an adjustable spirit level across the rifle and between the sights.

APPARATUS FOR CLEANING LOCOMOTIVE ASH PANS.

Paul K. Dealy, St. John, Can.—The novel feature here is the combination of the steam boiler of the locomotive (by a steam and water pipe) with the ash pan, the pipe extending through the ash pan and branching out into a number of issuing pipes, that clean effectually the ash pan by means of water or steam, as required.

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The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

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Wanted—Address of the person who makes dumb waiters for houses. J. L. Alberger & Co., Buffalo, N. Y.

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American Metaline Co., 61 Warren St., N.Y. City.

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The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

Solid Emery Vulcanite Wheels—The Original Solid Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams cor. of Plymouth and Jay, Brooklyn, N. Y.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph &c.

Notes & Queries

A. J. will find directions for stereotyping on p. 363, vol. 30.—J. T. can blue steel articles by the process given on p. 123, vol. 31.—J. K. will find an explanation of the theory of the crank on p. 112, vol. 31.—R. J. T. should consult a physician.—J. F. is informed that etching on glass is described on p. 409, vol. 31.

(1) W. B. G. asks: At what angle should mower knives be ground, so as to give the best and most desirable edge? A. It depends upon the material to be cut.

(2) W. K. says: Inasmuch as the question whether sparks of electricity can be discharged from the body of a workman in a powder mill, and cause an explosion, is agitating the minds of scientists, I send you an account of an incident which came under my observation a number of years ago. On a bitterly cold wintry day, a friend and myself started in a sleigh to make a visit. On retiring at night, my friend, after having removed an entirely woolen garment, threw it carelessly over his arm. Having laid it down, he approached the said garment with his other hand; and upon so doing, he was amazed to see an immense number of sparks all over the garment, as if it were on fire. This was accompanied with a noise similar to that produced by a voltaic battery. He withdrew his hand, and the sparks were gone, then reapplied it, and the same phenomenon was observed, in a less striking manner, however. Reapplying his hand for the third time, but a few sparks were seen, without any noise whatever. Where did the sparks proceed from? A. The sparks were caused by friction. They are often observed in removing woolen clothes in winter, especially when the air is very dry.

(3) R. B. B. asks: What would be the practical difference between cutting off steam at $\frac{1}{8}$th stroke, and throttling the steam until just $\frac{1}{8}$ of the full working pressure is realized? A. To cut off the steam at ⅛ stroke would be the more economical, there being in that case less loss from condensation.

(4) A. M. asks: How can I produce a fine high color on gold jewelry? A. Boil 8 ozs. saltpeter, 4 ozs. alum, and 4 ozs. common salt together in a porcelain or other fireproof vessel (not metallic), in barely sufficient water to dissolve them; add 9 ozs. strong muriatic acid to this solution, and filter. This quantity will be sufficient for coloring 4 ozs. of work at a time, and should be kept in a well stoppered glass bottle when not in use. Another recipe is: Boil 10½ ozs. saltpeter and 5¾ ozs. common salt together, in a porcelain dish, in a quantity of soft water barely sufficient to dissolve them, and ⅛ oz. nitrate of silver (lunar caustic) and 9½ ozs. muriatic acid; filter. This quantity will be sufficient for coloring 4 ozs. of work at a time, and should be kept in a well stoppered glass bottle when not in use. To color with either of the foregoing mixtures, anneal the work twice, and boil it, each time after annealing, in a pickle consisting of 8 parts water and 1 part sulphuric acid. Then pour a sufficient quantity of the coloring mixture into a porcelain dish, and heat it to about 150° Fah. Hold the work in this for about two minutes, then take it out and rinse it in clean water. If not sufficiently colored to suit, repeat the process until the desired color is obtained. Another and more common method among jewelers is to make a kind of paste, consisting of 2 parts saltpeter and 1 part each of alum, sulphate of zinc, common salt, and a little water. These ingredients are well mixed in a mortar, and the articles to be colored are covered with the paste, laid upon an iron plate, and heated over a clear fire nearly to a black heat. They are then suddenly plunged into cold water and well washed. This insures a beautiful high color.

(5) F. H. D. asks: Will a locomotive, standing still on an up grade, move or start as easily up the grade when the crank is on a line from the axle to the point of the wheel which rests upon the rail as it would if the crank was at either side of this line? A. A locomotive should start equally well with one crank in any position, for if one is on the absolute dead center, the other is in a position to exert its maximum force.

(6) H. J. E. asks: 1. How much sulphuric acid must put to a gallon of water to take the scale from castings that are to be used for stove patterns, and how long should they remain in the acid? A. About one of acid to fifteen to twenty of water. 2. What kind of a bath should the castings be put into after they are taken from the acid? A. Wash with clean water, and keep in a quantity of water containing a little potash or soda in solution until required. 3. How should wax be applied for waxing iron stove patterns? A. The wax is applied by simple friction with the metallic surfaces. This increases the temperature sufficiently to impart a fine even coating to the metal. 4. How can I make good varnish for wood patterns? A. Use shellac in alcohol. A little gum sandarac is sometimes added to this.

(7) W. B. M. asks: How can engraving tools be hardened? I am greatly annoyed by their breaking. A. Use Stubs' steel, heat it to a low red heat, and temper to a straw color.

1. What is the best way to keep a boiler when not in use? I have one under my charge that is not used for several months in fall and winter. I generally run the water all out. Is that the best way to keep it? A. Yes. 2. I blow off a few inches at a time, never blowing out entirely when hot. A good many around here blow their boilers out while hot, and this of course has a tendency to cake the slush, etc., held in solution, on the plates; at least that is my opinion. Am I not right? A. Yes.

(8) W. F. R. says: I claim that a powerful lamp for heating purposes will give off more heat to the room if a piece of sheet iron be placed horizontally just above it than if nothing be placed above it. My friend says there will be no difference. Which is right? A. The amount of heat given off by the lamp will be equal in both cases, but the metal would distribute the heat more evenly throughout the room.

(9) A. H. asks: How can I cement emery to cast iron? A. Coat the iron with white lead paint, mixed thickly; and when dry and hard, apply emery and glue.

(10) T. D. asks: How can I obtain the index of an engine lathe? I have applied to some machinists, and I purchased screw cutting tables; and although I can strike some threads, still I am unable to ascertain the proper method, as my gears all run differently from those described in any published system. My leading screw is an 8 thread: my gears are 28, 33, 35, 42, 49, 56, two 63's, 70, 77, 84, 91, 98, 105, 112. The gear on the spindle (under the head stock on cone) is 46. Can you give me any instructions in regard to filling out an index? A. Multiply the number of threads to the inch you wish to cut by any small number, for instance, 4, and this will give you the gear for the lead screw. Then multiply the number of threads to the inch in your lead screw by the same number (4), which will give you the gear wheel for the spindle. If the wheels thus obtained are sizes you have not got, try 2, 3, 5, or any other number as a multiplier.

(11) G. P. says: A rubber belt slips very much. Some people tell me to put rosin on it, and some say pitch. Will you give me your advice? A. Use a mixture of equal parts of red lead, French yellow, and litharge; mix with boiled linseed oil and japan sufficient to make it dry quickly.

(12) K. B. says: We recently cast a pair of brass boxes for the crank wrist of an engine of 100 horse power. The boxes were finished at the machine shop of the factory for which they were made. After the engine had run about 20 minutes the boxes became so hot that it was necessary to stop and cool them; and they continued to heat until we were obliged to remove them. The men condemn the boxes on the ground of being made of poor metal. The boxes were made in the proportion of 1 part block tin to 9 parts good scrap copper. Do you consider this a good material? If so, what was the probable cause of their heating? A. Your mixture of brass was a good one, though 1 part less copper would have been better. The heating may have occurred from the brasses not leading true, from the wrist not being true, from its having too little wearing surface, from the brasses bearing too much on the sides of the box, or from any one of a variety of similar causes.

(13) R. asks: 1. Where should I apply for a place on the school ship Minnesota? A. On board. 2. Will the authorities take a boy who is not a native? A. Yes.

(14) S. S. S. asks: What is the best treatment to give a Georgia pine floor, to make it non-absorbent of water and easily kept clean? A. Apply raw linseed oil, as follows: Take a block of wood, about 10 by 15 inches and 2 inches thick; tack woolen cloths upon it, saturate the cloths with the oil, and rub the floor till you produce a gloss.

What is the best paint for a smooth, hard-finished wall? A. Take best white lead and tone it down to a gray with a little black and yellow, using very little of the latter, so as to give only a slight tint off of the white. The first coats will sink into the wall, appearing spotted in places; repeat the coats until there is a uniform gloss throughout; this may take 4 or 5 coats.

(15) J. W. S. asks: How are twisted gun barrels made? A. After the square bars are made, they are twisted around a mandrel and then welded. See No. 1 of "Practical Mechanism."

(16) J. H. G. asks: 1. Will soft gray iron castings do for cores for electro-magnets? A. Yes. 2. Will they receive and discharge magnetism quick enough for cheap telegraph instruments? A. Yes. 3. Is Léclanché's battery a patent? A. Yes. 4. Which gives the best results with a given length of wire, a long slim coil or a short thick one? A. A thick wire with few convolutions gives the best effect when the amount of current passing through it is comparatively great. A thin wire with many convolutions is best when the current is small but has considerable electro-motive force. 5. Is a cone of hourglass shape, with broad poles, any better or as good as a straight one? A. Somewhat better for equal weights.

(17) E. C. H. asks: 1. In making the core box for the pattern of a steam cylinder, should it be made exactly the same size as the core prints, or is some allowance made for shrinkage? A. Green sand cores shrink, while dry cores expand a little. The amount is, however, in either case too small to render any allowance necessary. 2. Is cast steel melted and run into molds, as cast iron is, to produce the various articles of a steel difficult to forge? A. Yes.

(18) J. M. S. asks: 1. Will No. 16 coppered wire do to construct a telegraph line ½ a mile in length? A. Yes, but iron is better. 2. Which is the best, a ground or a return wire? A. A return wire. 3. How many more cells of battery will it take with the ground than the return wire? A. Three times. 4. Can a good ground be made by putting a bar of ½ inch round iron in a hole 3x1x1, and then filling with scraps of old iron? A. Yes. This will be a pretty good one if the ground is wet.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

W. B. B.—Your boiler deposit consists of lime alumina, oxide of iron, and oily matters.—B. B.—It is celluloid.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Feat in Saw-Making. By J. E. E.
On Large Safes. By S. H. R.
On Life-Saving Apparatus. By B. F.
On Copying Photographs. By J. C. C.
On Reaching the North Pole. By C. S.
On Fast Trains. By H. B. C.
On a Marine Governor. By P. A. H.
On Interstellar Space. By A. H. McK.
On Electric Motors. By H. M. P.
On the Locomotive. By F. G. W.
On the Psycho Mystery. By T. M. W.
On Mineral Wool. By A. D. E.
On Electric Force. By J. P.
On Terrestrial Magnetism. By N. S. W.

Also inquiries and answers from the following:

R. C.—J.—J. C. B.—J. W.—P. S. A.—H. H. H.—M.S. J. J. A.—T. M. W.—H. P. G.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes air and gas engines? Who sells cheap ice machines? Who builds windmills? Where can native potash be obtained? Who sells pumps and water pipes made of glass? Who makes the best velocipedes? Who sells engine indicators? Who sells shadow pictures?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 2, 1875.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air, devaporizing, L. K. Fuller 169,535
Arm pit shield, E. C. Bragg 169,515
Bale tie, C. H. Chase 169,521
Bale tie, R. Stewart 169,493
Baling short cut hay, C. Brown 169,518
Ball and socket joint, E. T. Starr 169,383
Barrels and kegs, head for, E. Foote 169,350
Basket, folding, G. Hammersle 169,398
Baskets, stave, H. C. Jones 169,446, 169,447, 169,448
Battery, galvanic, C. Duhem 169,529
Bedstead, table, E. Kiss 169,554
Belt fastener, W. M. Chapman 169,416
Belting, uniting the ends of, C. C. Roe 169,482
Billiard chalk holder, J. Simonton 169,488
Bird cage hook, Osborn & Drayton 169,571
Blind slat adjuster, G. Nichols 169,570
Boats, machine for framing, C. Bartlett 169,334
Bobbin, H. J. Hubbard 169,546
Boiler covering, F. B. Stevens 169,494
Boiler, feed, S. Olmstead 169,469
Boiler, steam, T. W. Godwin 169,432
Boiler, feed water heater, W. J. Austin 169,332
Books, fireproof covering for, E. W. Glover 169,526
Boot-nailing machine, W. Fitzgerald 169,429
Boot uppers and soles, uniting, Mckay & Fairfield 169,463
Bottle stopper, A. Luthy 169,456
Bracket, adjustable, E. T. Starr 169,382
Brake, double acting air, H. L. Perrine 169,575
Brick machine, C. N. Fisher 169,428
Bridle bit for horses, Bellinger, Bolles & Fryer 169,403
Broom machine, mandrel, H. Anderson 169,330
Buckle, trace, M. T. Burke 169,519
Burial case, metallic, H. M. Gray 169,436
Burner, liquid fuel, G. H. Perkings 169,372
Burner lens attachment, M. C. Meigs 169,360
Button feeding device, Z. Gelinas 169,433
Cake making feeder, D. H. Lafferty 169,556
Can, oil, N. Peterson 169,576
Cane and umbrella, J. Boyd 169,406
Cane and whip, O. H. Saxton 169,485
Car brake, S. G. Howe (r) 6,721
Car brake, J. N. Sawkins 169,593
Car couch, T. H. Neal 169,569
Car coupling, A. Cyr 169,424
Car coupling, H. F. McKervey 169,563
Car wheel, W. H. Paige 169,370
Cars, gong for street, W. Guilfoyle 169,356
Carriage, curtain fixture, Knight & Ripple 169,555
Carriage top, R. F. Painter 169,371
Carriage top, Power & Anderson 169,579
Carriage umbrella top, L. P. Tibbals 169,599
Catarrh, cure of, J. W. Harvey 169,540
Chain links, bending, J. Baird 169,333
Chair seats, material for, D. H. Donovan 169,528
Chemist's test apparatus, C. Fahlberg 169,348
Cherry stoner, S. A. Darrach 169,525
Children inclosure for, H. J. Parker 169,471
Cigar pipe, R. L. Weed 169,501
Clothes dryer, G. A. Brooks 169,517
Clothes line reel, C. L'Hommedieu 169,453
Clutch, B. F. Young 169,394
Cock, stop, R. G. Smeaton 169,489
Coffee roaster, F. Thomas 169,498

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Comb, band, A. Poppenhusen..... 169,578
Cooking steamer, M. Pifer..... 169,373
Copy book, letter press, S. W. Soesbe..... 169,491
Cotton gin, W. S. Reeder..... 169,564
Cotton scraper, R. L. McClung..... 169,462
Curtain fixture, F. Backofen..... 169,400
Curtain fixture, E. B. Lake..... 169,450
Cylinders, valve for steam, J. N. Lauder..... 169,452
Dental engine, S. D. Engle..... 169,345
Dental engine, W. W. Evans.....169,346, 169,347
Dental engine, E. P. Ryder..... 169,375
Dental engine hand piece, G. H. Cushing..... 169,342
Desk, school, T. Redmayne 169,478
Digger, potato, D. J. Roush..... 169,483
Door check, Breidenback & Euchenhofer..... 169,407
Door spring, J. M. Blood..... 169,405
Door spring attachment, W. M. Gray..... 169,351
Draftsman's ink saucer, F. Stith..... 169,597
Drawing board attachment, J. C. Hintz..... 169,543
Drilling machine, tripod, J. B. Waring..... 169,389
Dropper, potato, Zane & Kennedy..... 169,395
Drying apparatus, T. Webber..... 169,500
Dye, W. H. Seaman..... 169,378
Earth-boring apparatus, Ruth & Crain..... 169,590
Earth-preserving compound, E. A. Snyder..... 169,595
Electricity, lighting by, Viosin & Dronier..... 169,387
End gate, E. G. Martin. 169,461
Engine, rock-drilling, G. H. Reynolds..... 169,587
Engine, rotary, I. Van Kersen..... 169,603
Excelsior, making, L. H. Whitney..... 169,607
Exercising apparatus, J. B. Newbrough..... 169,467
Eyeleting machine, J. J. Allred..... 169,398
Faucet, measuring, F. C. Heiser (r)..... 6,722
Fence, barbed wire, A. V. Wormley..... 169,393
Fence post support, H. McKenzie..... 169,562
Fenc, wire, J. M. McClellan 169,369
Fertilizer distributer, W. H. Cook..... 169,523
Fire arm, breech-loading, C. E. Billings..... 169,335
Fire-arm, breech loading, H. C, Bull..... 169,413
Fire blower, J. Reid..... 169,585
Fire plug, C. F. Rapp..... 169,476
Fire shield. Moore and Bradley..... 169,466
Fires, extinguishing, H. Conant..... 169,422
Floor, refrigerating, Rochevot and Schmidt..... 169,481
Fluting iron, Fisher and Brown..... 169,534
Fluting machine, H. Albrecht..... 169,327
Fork, barley, S. Snell..... 169,594
Fork, hay, M. M. Cherry..... 169,417
Fruit jar, C. R. Carter..... 169,340
Fruits, preserving, F. H. L. C. Sacc..... 169,591
Furnace, J. K. Caldwell..... 169,338
Furnace, hot air, S. E. Foster (r)..... 6,727
Furnace, hydrocarbon, P. M. Qvist..... 169,533
Furnace, reverberatory, J. Price..... 169,581
Furnace, steam boiler, J. Enright..... 169,531
Furnace, steam boiler, J. A. Locke 169,455
Furnaces, pushing tube skelps into, G. Matheson 169,460
Gas, lighting, Green and Barrow..... 169,352
Gas fitters' hooks, blank for, J. W. Lyon..... 169,364
Gas on air, etc., enriching, E. H. Covell..... 169,423
Gas, regulating flow of, Jacobsen and Murphy... 169,549
Gaseller, drop light, J. Fox..... 169,430
Gate, J. A. Knepper..... 169,449
Gate latch, S. Cherry..... 169,418
Glass, decorating, J. Budd..... 169,412
Glass spheres, blowing, F. Rhind..... 169,479
Glove, gauntlet, Latcher and Dunham..... 169,351
Grain binder, S. S. Jackman..... 169,360
Grain decorticator, S. Dodson..... 169,426
Grain drill, feeding, A. J. Martin. 169,561
Grain scouring, W. P. Robinson..... 169,589
Grate, J. A. Buckwalter..... 169,411
Gun stocks, recoil check for, W. D. Miller..... 169,465
Hame fastener, A. J. Park..... 169,572
Hand cuff, G. P. Houston 169,443
Hay, baling short cut, C. Brown..... 169,518
Hay ricking apparatus, J. R. Hill..... 169,542
Horse and water power, W. S. Watkins 169,391
Horse power, J. Smith..... 169,380
Horses in engine houses, releasing, C. Sibert..... 169,379
Horseshoe, S. Stone..... 169,495
Horseshoe nails, rolling, G. L. Hall..... 169,357
Hose pipe nozzle stand, O. Edwards..... 169,344
Hydrant, W. D. Greanelle..... 169,538
Induction apparatus, R. K. Boyle..... 169,514
Iron and steel from ore, producing, W. A. Lyttle 169,560
Ironing board, W. M. Tobey..... 169,600
Jack, carrying, A. K. Norris..... 169,369
Knitting machine, C. J. Appleton..... 169,331
Knobs to spindles, attaching, C. Coleman..... 169,421
Lamp, F. A. Taber..... 169,497
Lamp extinguisher, Warren and Packard..... 169,604
Lantern, H. Beebe..... 169,511
Lantern, C. H. Lyman..... 169,457
Letter box and door bell, J. Lovenguth..... 169,358
Liquids, expressing, L. Breval (r)..... 6,721
Lock, door, C. L. Bates 169,401
Loom pattern chain, J. F. Wicks..... 169,608
Loom shedding mechanism, O. W. Kenison..... 169,552
Loom shuttles, D. Wright..... 169,504, 169,505
Loom weft stop mechanism, O. M. Stillman..... 169,596
Mail bag catcher, E. F. Hotchkiss..... 169,545
Mains, machine for tapping, J. Hancock..... 169,438
Match, safety, E. Haanel..... 169,539
Mattress and cushion, W. H. Horton..... 169,442
Meats, preservation of, F. H. L. C. Sacc 169,592
Mechanical movement, O. Child..... 169,34
Millstone-dressing machine, G. Heydrich 169,440
Molders' plates, operating, J. T. Peet 169,473
Mowing machine, A. G. Gray..... 169,435
Nets, manufacture of, J. H. Coevoet..... 169,522
Oven, bakers', J. Bieder..... 169,404
Overshoe, J. I. Mellon (r)..... 6,725
Packing, piston, G. H. Reynolds..... 169,586
Paint breamer, J. P. Hayes..... 169,439
Paper bag, C. Amazeen..... 169,399
Paper bag for brooms, E. D. Messinger..... 169,464
Paper box, F. Salomon..... 169,484
Paper collars, cutting, C. A. Brown..... 169,408
Paper perforating machine, J. S. Ives..... 169,548
Pattern chart, M. A. and L. A. Melcher..... 169,564
Pegging machine, leather screw, C. M. Higgins. 169,541
Piano, upright, G, Trayser..... 169,386
Pinchers, crimpers', Wright and Bassett..... 169,503
Pipes, F. G. Merriam 169,565, 169,566
Pipe, cigar, R. L. Weed..... 169,501
Pipe drilling machine, F. Grinnell..... 169,354
Pipe, sprinkline, F. Grinnell..... 169,355
Pipe stem, J. W. Fleischmann..... 169,349
Pipe tongs, S. H. Dickerson..... 169,425
Pipes, drilling holes in, F. Grinnell..... 169,353
Planing machine primer, B. C. Chambers..... 169,520
Planter, check row, Klar and Dixon..... 169,361
Planter, corn, J. Bryer..... 169,409
Planter, corn, Gardner and Hayes..... 169,432
Plow, rotary gang, J. K. Underwood..... 169,499
Pocket book, D. K. Osbourn..... 169,470
Postal cards, filing, P. M. Hitchcock..... 169,441
Press, G. H. Reynolds..... 169,588
Printing press, oscillating, J. L. De Huff..... 169,526
Printing press, oscillating, W. C. Evans..... 169,532
Printing press, oscillating, Watson and De Huff.. 169,605
Pruning implement, Henkel and Ward..... 169,356
Railway, elevated, J. Westcott..... 169,606
Railway signal, F. Raymond..... 169,477
Railway signal, electric, E. E. Bean..... 169,509
Rain water cut-off, H. Wilkins..... 169,609
Rake, horse, W. Aldrich 169,329
Rake, horse hay, W. Aldrich..... 169,328
Ratchet movement, J. Parr..... 169,574
Roller for endless aprons, guide, J. Parr..... 169,573
Roofing composition, L. P. Teed..... 169,385
Bow lock, F. D. Graves..... 169,587
Sad iron, O. Swift..... 169,496
Safe and vault door, M. Briggs..... 169,337
Safe, burglar-proof, E. R. Morse..... 169,567
Salesman's seat, S. D. Sollers..... 169,381
Salt and pepper box, G. H. Lomax..... 169,363
Sash fastener, I. H. Stoddard..... 169,494
Sash holder, Frost & Merrill..... 169,431
Saw buck, H. Disston..... 169,343
Saw-gumming machine, H. Baughman..... 169,508
Sawing machine, scroll, W. H. Kimball..... 169,553
Sawing machine, scroll, L. C. Pratt..... 169,475
Scale beam, E. A. Chameroy..... 169,415
Sealing device, hermetic, T. Roberts..... 169,480
Seeder lifting device, W. A. Van Brunt..... 169,602
Seeding machine, W. P. Penn (r)..... 6,726
Sewing machine clamp, J. Dunn..... 169,530
Sifter, flour, Lintner, Weller, and Kellogg..... 169,454
Sink, L. Jones, Jr..... 169,551
Soap-boiling apparatus, M. J. Palmer..... 169,472
Spinning frame, J. E. Atwood..... 169,507
Spoke-tenoning machine, H. R. Carmany..... 169,414
Stove, G. W. Herrick (r)..... 6,723
Stove, C. Warren..... 169,390
Stove grate, W. B. Hosford..... 169,544
Stove, heating, W. B. Treadwell..... 169,601
Stove, magazine, J. A. Buckwalter 169,410
Stove pipe drum, E. S. Blake (r)..... 6,720
Swimming shoe, O. G. Ahlstrom..... 169,396
Syringe, shield, etc., E. T. Starr..... 169,384
Table leaf support, J. Wanner..... 169,388
Tailor's patterns, drafting, J. Bellamy..... 169,402
Tailor's pattern, J. H. Nichols..... 169,468
Telegraph, electric, R. K. Boyle..... 169,513
Telegraph, magneto-printing, G. L. Anders..... 169,506
Temperatures, regulating, A. Campbell 169,339
Tenoning machine, H. Brand..... 169,336
Testing machine, W. J. Scott..... 169,376
Thill coupling, T. J. Quick..... 169,582
Tobacco cutter, W. H. Pease (r)..... 6,728
Tobacco in bags, packing, J. B. Farrar..... 169,533
Tool handle, J. W. Miller..... 169,367
Toy, automatic, Ives & Pilkington..... 169,547
Toy ball, bell metal, J. C. Clark..... 169,419
Toy gun and horn, L. Duvall..... 169,427
Toy target, J. Poznanski..... 169,580
Transplanter, Johnson & Bowman..... 169,445
Truck, hand, J. Lugenbell..... 169,559
Valve, E. H. Beckwith..... 169,510
Vehicle spring, Corey & Neff..... 169,524
Venetian shade, C. Widemann..... 169,502
Ventilation of commodes, R. D. O. Smith 169,490
Vise, A. H. Brainard..... 169,516
Vise, A. O. H. P. Sehorn..... 169,486
Wagon box, T. Jenning 169,444
Wagon brake, H. Markrud..... 169,459
Warper, Moulton, Damon, & Rice..... 169,468
Washing machine, T. Allen..... 169,397
Washing machine, A. Hale..... 169,437
Watch, J. K. Bigelow..... 169,512
Watch regulator, E. McNutt 169,458
Watchman's register, D. Shive..... 169,378
Water filter and purifier, A. Le Tellier..... 169,362
Water meter, W. B. Mounteney..... 169,368
Water-supplying apparatus, J. N. Poage..... 169,577
Water traps, manufacture of, G. W. Wicks..... 169,392
Weatherboard gage, R. J. Dodd..... 169,527
Weather strip, J. Cleave 169,420
Well packing, drive, V, F. Thomacich..... 169,598
Whips, snapper loop for, H. H. Jones..... 169,550
Wrench, A. B. Lipsey 169,557
Yarn, etc., finishing, Rhodes *et al*..... 169,374
Yeast compound. J. Pfeiffer..... 169,474
Yoke, neck, C. Shuman..... 168,487

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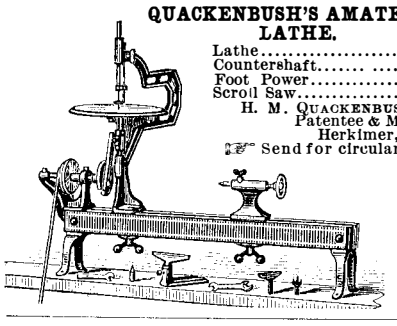

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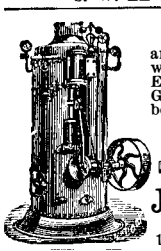

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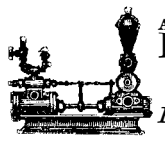

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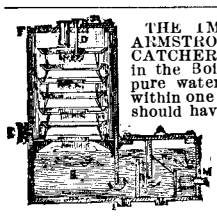

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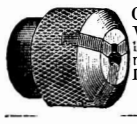

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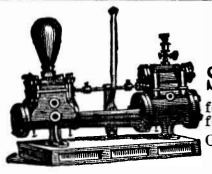

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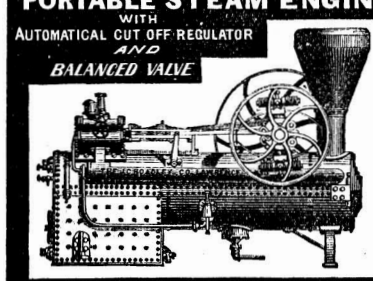

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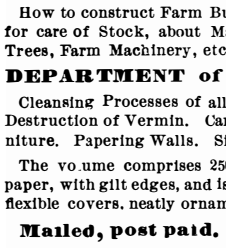

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